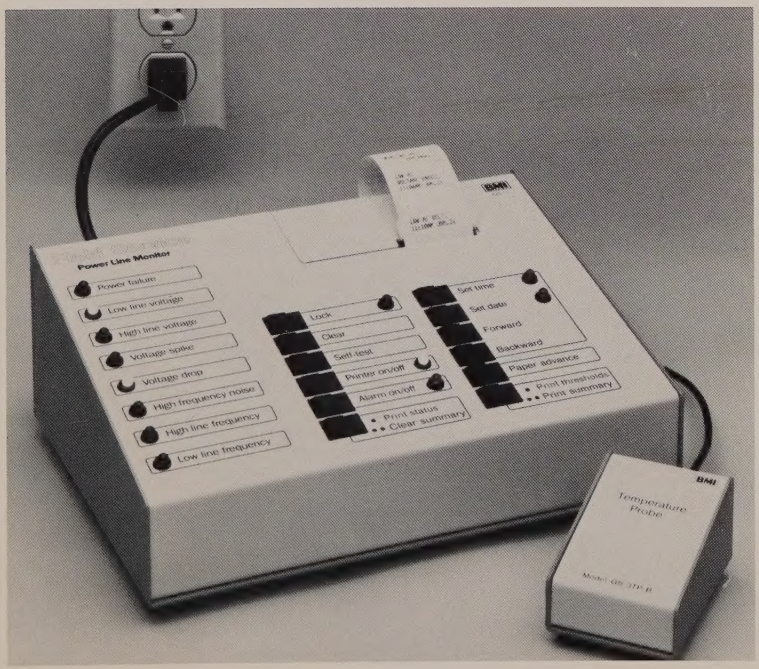
FOR G25415 CHANDLER

BMI GS-3 POWER LINE MONITOR



User's Guide
Tech Manual

BMI Basic Measuring Instruments

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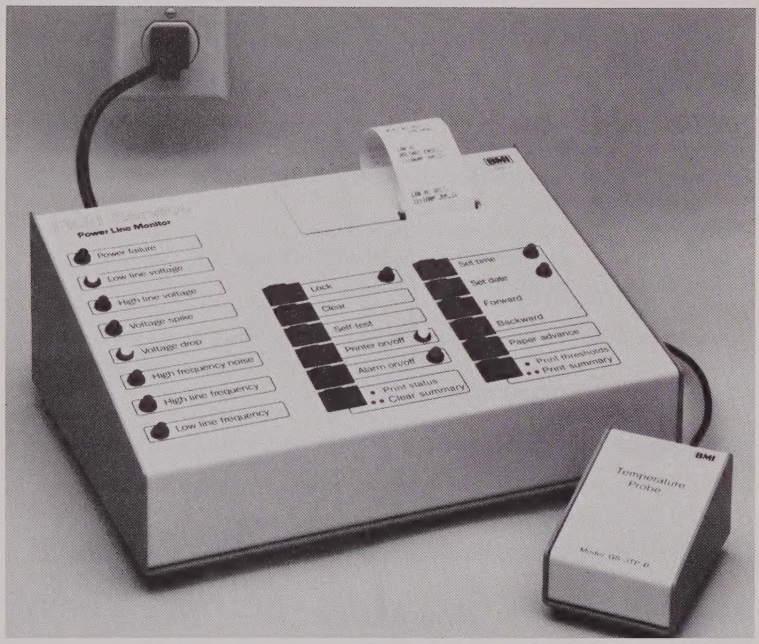


DESCRIPTION

BMI MODEL GS-3

The BMI Model GS-3 monitors single phase AC power lines, ambient temperature, and a DC voltage such as might be produced by common power supplies. The monitor records disturbances, or variations, in these parameters which may affect normal operation of computers, word processors, automatic test equipment, medical instruments, industrial controls, and other sensitive electronic equipment.

This monitor is extremely easy to use. To install it, simply plug it into the power line to be monitored.

The GS-3 is equipped with alarm lights to annunciate disturbances and a thermal printer to record them. Internal rechargeable Ni-Cad batteries maintain the GS-3's clock and calendar during power failures (or when the GS-3 is unplugged). The audible alarm annunciates voltage disturbances if desired, or it can be switched off.

Detachable probes for temperature and DC monitoring are provided as standard equipment. An RS-232 interface and a **"Phase Neutral Wiring Correct"** LED round out the GS-3's list of standard features.

BEFORE USING THE GS-3

RETURN THE WARRANTY CARD

By returning the warranty card, you do yourself and us a favor. You help us because we get to know who is actually using our equipment. For you, the customer, the advantages are much more substantial.

Advantage #1: As a registered GS-3 user, you will get regular communications from BMI regarding product applications.

Advantage #2: Information on new products will be sent directly to you, so you can evaluate them in terms of your work requirements.

Advantage #3: If your analyzer is ever sent to the factory for repair, we will be able to consult directly with you to make sure we understand the problem.

So, please take a minute now and return the filled-out warranty card.

MAKE SURE THE OPERATING VOLTAGE IS CORRECT

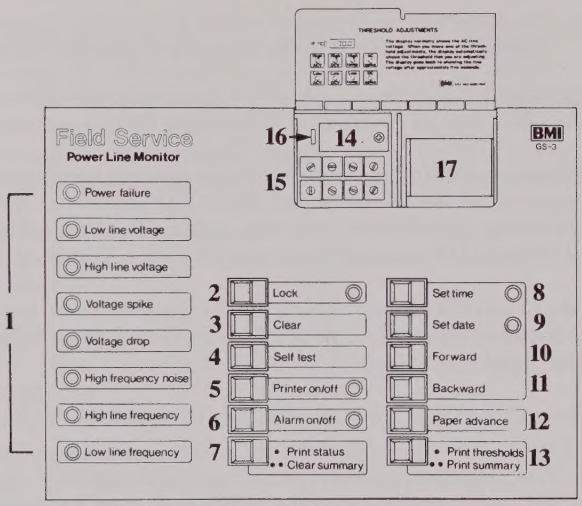
When a GS-3 is shipped from the factory, the S/N tag on the back indicates the proper nominal operating voltage: either 120 or 240 VAC. Make sure a GS-3 set to operate on 120 VAC is not plugged into a 240 VAC source! (Doing so will blow the fuse and possibly cause internal damage not covered by the warranty).

To verify proper operating voltage:

1 Plug the unit into 120 VAC. Press **"Print Status"**. If a proper report is printed, showing the expected voltage, all is well. If not, continue:

2 Refer to the Section on 120 Volt/240 Volt Operation, page 11. If 120 VAC operation is desired, be sure DIP switch 8 is set to OFF, and the 120/240 switch is set to "120". Or, if 240 VAC operation is desired, the DIP switch is set to ON and the 120/240 switch is set to "240".

FRONT PANEL CONTROLS AND INDICATORS



Front Face GS-3

1 **Alarm LED's:** These LED's will light to show that **at least one** of a particular type of disturbance has occurred. During a power failure lasting longer than about 5–10 seconds the LED's will turn off. When AC power is reapplied, the lights will return to their previous state.

2 **Lock Button and LED:** Depress this button to turn the LED on and lock the GS-3. When locked, the GS-3's response to the pushing of any button on the front panel (#2 through #13) is four beeps and the display of the message "8.8.8.8." on the LED display.

See the Sections on Locking and Unlocking the Monitor, pages 8 and 9.

3 **Clear Button:** The **Clear** Button has several functions:

a) Push the **Clear** Button at any time to extinguish the alarm LED's. Data stored in the Summary is not affected.

b) During a lengthy printout, depress the **Clear** button to terminate the printout. The **Alarm LED's** will be extinguished as in (a) above.

c) The **Clear** button is used with the **Lock** button to unlock the GS-3. See the Sections on Locking and Unlocking the Monitor, pages 8 and 9.

d) The **Clear** button is used to return the monitor to normal operation after being in the calibrate mode. See Appendix B.

4 **Self-test Button:** Depress this button to initiate an automatic test of the GS-3. See the Section on Self-testing Operation, page 9.

5 **Printer on/off Button:** Pushing this button will toggle the printer between the **On** and **Off** states. The LED lights when the printer is **On.** Direct commands to the GS-3 such as **Print Status** will override the **Printer Off** state and a normal printout will be made.

6 **Alarm on/off Button:** Pushing this button will toggle the audible alarm **On** and **Off**. See the Section on Turning the Alarm On and Off, page 7.

7 **Print status/Clear summary Button:** This button has 3 functions:

a) Press this button **once** to print a **Status** report which includes time and date, present line voltage and frequency, and present DC voltage and temperature (if in use). See Appendix A.

b) Press this button **twice,** with about ½ second between pushes, to **Clear Summary.** This will clear all data stored in the **Summary** report and start a new **Summary** period. See Appendix A.

c) Press the button **three** times to print the software revision level. This information is useful in understanding the exact operation of the monitor, especially when consulting with the factory. See the Section on The Software Revision Level, page 8.

8–11 **Set time and date Controls:** These are used in setting time and date. See the Sections on Setting the Time and Setting the Date, page 8. The **Forward** button is also used during calibration. See Appendix B.

12 **Paper advance Button:** Holding this button down will continuously advance the paper.

13 **Print thresholds/Print summary Button:** This button also has three functions:

a) Push it **once** to print out all thresholds. See the Section on Threshold Adjustments, page 12.

b) Push it **twice** to print out a Summary of all disturbance events. This includes the "worst case" and count of each disturbance type. See Appendix A.

c) Push the button **three** times to enter calibration mode. See Appendix B. Push the **Clear** button to return to normal operation.

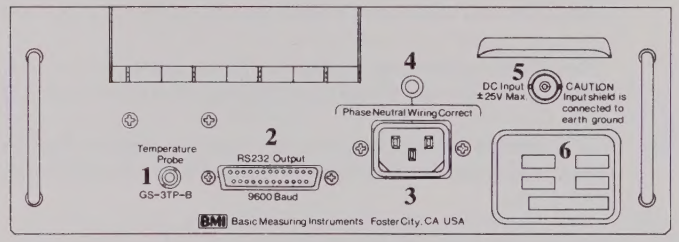
14 **LED Display:** During normal operation this will show the AC line voltage. It is also used during threshold adjustment, setting time and date, and calibration. See those Sections for more information.

15 **Threshold Adjustment Trimpots:** These are used to adjust thresholds. See the Section on Threshold Adjustments, page 12.

16 **°F/°C Switch:** This allows the user to select degrees Fahrenheit or degrees Celsius for the monitoring and recording of temperature variations.

17 **Thermal Printer:** See the Section on Turning the Printer On and Off, page 7, and the Section on Changing the Printer Paper, page 9.

REAR PANEL CONNECTORS AND INDICATOR



Back Face GS-3

1 **Temperature Probe Connector:** Plug the GS-3TP-B temperature probe and cable into this connector to monitor ambient temperature. Be sure the cable is fully seated at both ends.

2 **RS-232C Connector:** The GS-3 will output ASCII data which is a duplicate of all printouts. The data is transmitted at 9600 baud. Each character has 1 start bit, 7 data bits, and 1 stop bit. As shipped from the factory, the RS-232C is configured as a DCE, with data transmitted on Pin 3. An internal switch (See Figure C-6 in Appendix C) will convert the unit to DTE, transmitting data on Pin 2. As shown, the pair of switches at the lower left labeled "RS-232 SELECT" will cause data to be transmitted on Pin 3. Reverse the switch positions to transmit on Pin 2. Signal ground is Pin 7.

3 **AC Power Receptacle:** A standard IEC type recessed power receptacle is provided, to mate with the molded power cord.

4 **Phase Neutral Wiring Correct LED:** This LED will light if the line, neutral and ground wiring is correct (on a 120 VAC line).

5 **DC Input:** The DC monitoring cable is connected here to perform DC monitoring.

6 **Serial Number Tag:** This tag is applied at the factory, and shows model number, serial number, options, and operating voltage and frequency.

USING THE MONITOR

Getting Started

Unpack the monitor, and plug the power cord into the socket on the back of the monitor. When new, the connector may be stiff; push it in firmly to be sure it is completely seated.

Plug the monitor into the power line to be monitored. The outlet must be grounded. (If an ungrounded outlet is monitored, spikes and high frequency noise may not be monitored properly. See the Sections on Voltage Spike (page 18) and High Frequency Noise, page 21.) The monitor does not have a power On/Off switch; it is On whenever it is plugged in. Leave it plugged in even when not in use, to keep the batteries fully charged.

Verify that the wiring of your outlet is correct by looking at the **"Phase Neutral Wiring Correct"** light on the back of the unit. If the light is off, check the wiring of the outlet in question. (If you have the monitor plugged into an isolation transformer this light may not turn on).

Look at the LED display under the printer door on the front panel of the monitor. This shows the RMS voltage of the power line being monitored. (Other functions of this display are described elsewhere.)

Press the **Print Status** button once. This will give you a report of the time and date, the line voltage, the line frequency, and the condition of the batteries. DC voltage and temperature will be reported if these are being monitored.

Press the **Print Thresholds** button once. This will list all settings as described in Appendix A.

Turning the Printer On and Off

Turn the printer on and off by pressing the **Printer On/Off** button. You will get a printed message showing that the printer was turned on or off. If the **Printer On/Off** light is on, the printer is on; the monitor will then give you a printed message whenever a disturbance occurs. Each message will also show the time and date that the particular disturbance occurred.

Turning the Alarm On and Off

Turn the audible alarm on and off by pressing the **Alarm On/Off** button. If the **Alarm On/Off** light is on, the alarm will beep four times whenever a disturbance occurs on the power line.

Setting the Time

Pressing the **Set time** button will cause the time to be shown in the display. The **Set time** light will also turn on to acknowledge that the monitor is ready for you to change the clock setting.

Use the **Forward** and **Backward** buttons to adjust the setting of the clock. The display will continuously show the time as you change it. You can adjust the time quickly by holding down either the **Forward** or **Backward** buttons, or you can adjust it slowly by just tapping the buttons.

The display will automatically go back to showing the line voltage when you have finished setting the time, or if you pause more than about five seconds.

Setting the Date

Setting the date is performed in the same manner as setting the time. Press the **Set Date** button to bring the date into the front panel display. On the monitor's calendar, February always has 29 days.

If the batteries have been completely discharged, the clock/calendar is automatically set to noon on January 1.

Leave the monitor plugged in, even if not in use, to keep the batteries charged. When fully charged, the batteries will operate the clock/calendar for about two weeks without external power.

The Software Revision Level

The software inside your monitor specifically defines its operation. Pressing the **Print Status/Clear Summary** button three times will print a message telling you what the software revision level is.

Locking the Monitor

The monitor's keyboard may be locked to prevent casual tampering with the controls. You can do this by pressing the **Lock** button.

When the **Lock** light is on, the front panel of the monitor is inoperable. Pressing any button at this time will make the **Lock** light flash and the alarm beep.

Unlocking the Monitor

The monitor can be unlocked in the following manner:

First, press and hold the **Clear** button.

Second, press and hold the **Lock** button.

Third, release the **Clear** button.

Finally, release the **Lock** button. The **Lock** light will turn off, and the monitor's keyboard will be unlocked.

Changing the Printer Paper

The printer paper needs to be changed when a red line appears along the edge of the paper. Hold the printer door open and press the **Paper Advance** button to remove the remaining paper.

Remove and discard the cardboard roller from the printer, if one is present.

Make sure that the edge of the new roll of paper is straight and smooth. Merely folding the paper over will accomplish this.

Feed the edge of the paper into the slot at the front of the paperholder. When fed through correctly, the edge of the paper can be seen in the small rectangular opening immediately below the small rubber roller.

Press the **Paper Advance** button until the paper comes out the front of the printer. If the paper is not being pulled off the roll, check to make sure that it was fed into the printer correctly.

Cleaning the Printer

Occasionally the printer will produce slightly smudged printout. To clean the printer, first remove the thermal paper roll. Then take a piece of thermal paper about six inches long and feed it through the printer so that the printer attempts to print on the backside of the paper. Then replace the thermal paper roll.

Self-Testing Operation

The monitor may be tested by depressing the **Self-test** button.

The self-test sequence checks the LED's, the processor, the EPROM'S, the RAM, the memory interface and decode circuits, the input/output circuits, the audible alarm, and the alarm timing circuits.

If the self-test fails, contact the factory.

OPTIONAL SWITCH SETTINGS

The Model GS-3 allows for optional settings for the power failure and power restored thresholds, line frequency tolerance, high frequency noise alarm disable, 120V or 240V operation, PHASE-ground or NEUTRAL-ground spike and high frequency noise sensing, and disabling of the Automatic Midnight Summary Report.

Power Failure/Power Restored Thresholds

These thresholds are determined by switches 1, 2, and 3 on a row of DIP switches located on the upper (digital) board. Accessing these switches requires opening up the monitor. To open the monitor and locate these option switches, refer to the diagrams in Appendix C of this manual.

With the two halves of the chassis separated, set switches 1, 2, and 3 to the desired threshold according to the table below. The Power Restored threshold is automatically set to five volts above the Power Failure threshold.

Power Failure Threshold (120 Vrms/240 Vrms)	switch 1	switch 2	switch 3
80 Vrms/160 Vrms	OFF	OFF	OFF
82 Vrms/164 Vrms	ON	OFF	OFF
85 Vrms/170 Vrms	OFF	ON	OFF
87 Vrms/174 Vrms	ON	ON	OFF
90 Vrms/180 Vrms	OFF	OFF	ON
95 Vrms/190 Vrms	ON	OFF	ON
100 Vrms/200 Vrms	OFF	ON	ON
105 Vrms/210 Vrms	ON	ON	ON

Automatic Midnight Summary Report Disable

The monitor will automatically print a **Summary** of all disturbance events each night at midnight, as described in Appendix A. This is a standard feature of the monitor as it is shipped from the factory. If DIP switch 5 is moved from OFF to ON this automatic printout is disabled.

High Frequency Noise Alarm Disable

DIP switch 6 can be used to disable the high frequency noise alarm. The monitor is normally shipped with switch 6 OFF. If this switch is moved to the ON position, the monitor will ignore all high frequency noise disturbances.

Line Frequency Tolerance

DIP switch 7 adjusts the line frequency tolerance. If this switch is in the ON position, wide frequency tolerance (± 2Hz) is selected. In the OFF position the tolerance is ± 1Hz. The software automatically selects 50Hz or 60Hz operation.

120 Volt/240 Volt Operation

The GS-3 can be set up to monitor nominal line voltage levels of either 110-120 Vrms or 208-220-240 Vrms. This is controlled by setting DIP switch 8 on the upper (digital) board and setting the 120/240 slide switch on the lower (analog) board. Refer to Appendix C for the location of these switches.

For 110-120 Vrms operation, set switch 8 to the OFF position and set the 120/240 switch to 120.

For 208-220-240 Vrms operation, set switch 8 to the ON position and set the 120/240 switch to 240. (Switch 8 tells the software whether 120 or 240 nominal is to be monitored.)

To monitor power lines other than 120 Vrms or 240 Vrms select the setting that is closer in voltage to the line being monitored. The exact voltage thresholds can then be adjusted accordingly. (See the Section on Threshold Adjustments).

NOTE: Unused DIP Switch

DIP switch 4 is not used by the monitor.

PHASE-Ground and NEUTRAL-Ground Spike Sensing

You can select between PHASE-ground and NEUTRAL-ground spike and high frequency noise sensing by setting the PHASE/NEUTRAL slide switch on the lower (analog) board to either PHASE or NEUTRAL respectively. The Section on **Voltage Disturbances, Printouts, and Solutions** describes the difference between these two settings. (The standard set-up as shipped from the factory is PHASE-ground.)

THRESHOLD ADJUSTMENTS

Eight monitoring thresholds may be adjusted by use of the trimpots under the printer door. To adjust the thresholds to appropriate values, do the following:

a) Check the specifications for AC voltage tolerance and temperature variations, as provided by the manufacturer of your computer or other equipment. Most manufacturers do not specify spike tolerance, but thresholds between 100 and 200 volts are frequently used in the field.

b) DC thresholds may be selected based on the power supply being monitored.

c) Turn the Printer OFF so that printouts will not interfere with the adjustment procedure.

d) Refer to the "THRESHOLD ADJUSTMENTS" tag inside the printer door to locate the desired adjusting trimpot. For example, the "HIGH ACV" adjustment is the upper left hand trimpot.

e) Insert a small screwdriver into the desired trimpot and twist the adjusting screw back and forth. **The LED Display will continuously display the threshold as it is varied.**

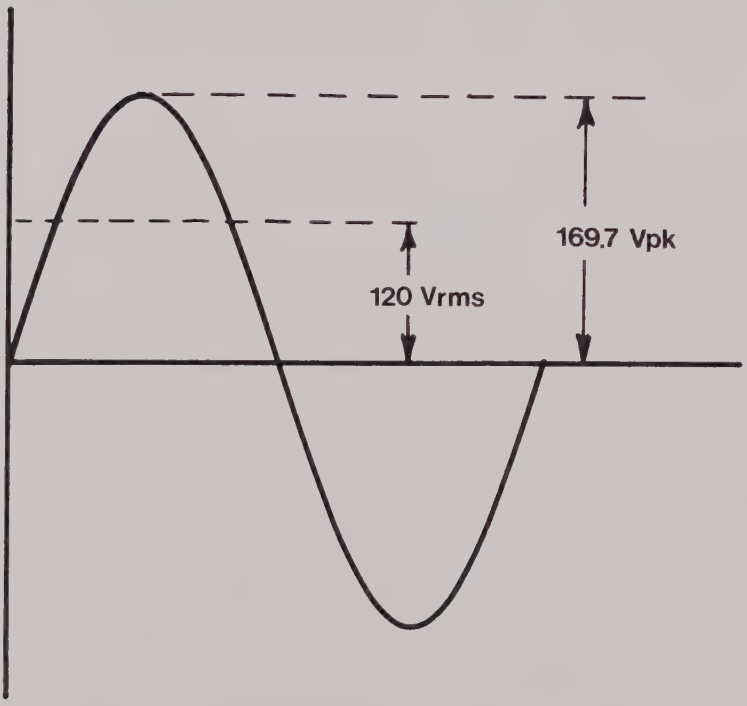
f) Adjust the threshold to the desired level.

Repeat (e) and (f) until all relevant thresholds are set. **Then push the Print thresholds button to print all thresholds for proper verification and documentation.**

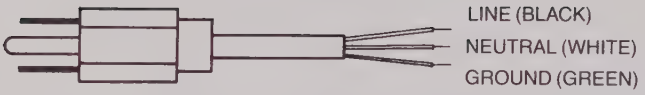
VOLTAGE DISTURBANCES, PRINTOUTS, AND SOLUTIONS

VOLTAGES

In order to approximate the behavior of a linear power supply, all voltage measurements are peak sense equivalents of the true RMS voltage as measured from line to neutral (unless indicated otherwise below). Consequently, a distorted sine wave on the power line may cause a high or low line voltage indication, even if an RMS reading of the power line indicates that it is within the threshold. The measurement is made through a low pass filter to eliminate the effects of higher frequency transients.



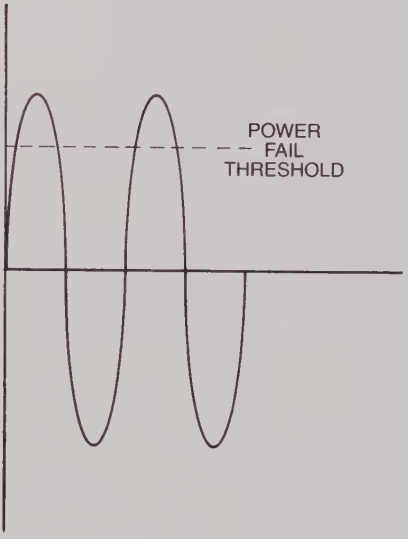
A 120 VAC RMS line measures approximately 169.7 peak. This is the measurement made by the GS-3, which is then calibrated to show RMS.



These are the standard color coding and names for the three conductors in a 120 VAC circuit. 208/220/240 lines are similar but not the same.

POWER FAILURE

The power failure measurement is made from line to neutral. The power failure indication occurs when the peak sense equivalent drops below the power failure threshold continuously for longer than approximately ½ second.



Voltage falls below power failure threshold **and stays below it** for approximately ½ second or longer.

Causes and Solutions

Power failure is perhaps the ultimate power problem. It can be caused by electric utility failure, or possibly by lightning or general system failure. Circuit breakers or fuses may be tripped or blown by overloads. These

situations may be corrected by re-wiring or redistribution of loads. Breakers should be labelled carefully to avoid accidental switching by maintenance personnel.

Power failures which cannot be eliminated by reasonable user intervention can be tolerated if they are not too frequent. Battery backup for semiconductor memory with auto-start hardware and appropriate recovery software will often suffice to prevent catastrophic loss of essential data or programs. If continuous operation is required a UPS should be considered. When selecting a UPS, keep in mind the following key factors:

- Battery life—usually 5-15 minutes, which will bridge 99 + % of power failures.
- On-line or off-line UPS—On-line UPS will usually provide clean power all the time. Off-line types sometimes pass "dirty" AC right through to the load—**FIND OUT!**

GS-3 PRINTOUT

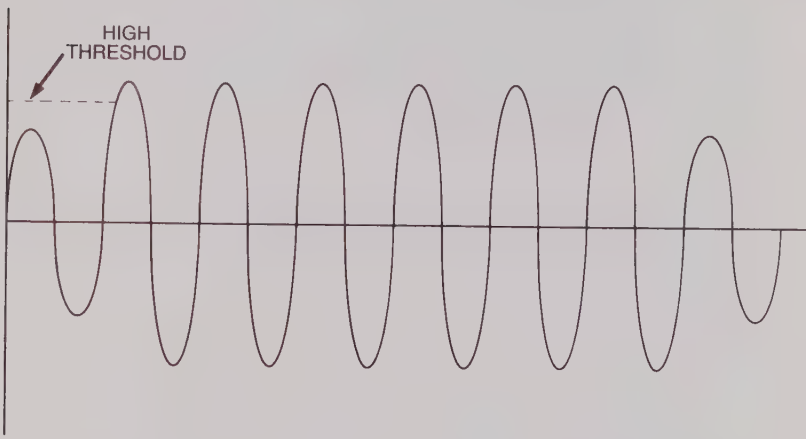
```
AC SPIKE:
      +454 Vpk
11:47AM MAY 2

VOLTAGE DROP:
11:47AM MAY 2

LOW AC VOLT.
11:47AM MAY 2

POWER FAILED.
11:47AM MAY 2

POWER HAS
BEEN RESTORED.
11:47AM MAY 2

MIN. AC VOLT.
        0 Vrms

LOW AC
VOLTAGE ENDED.
11:47AM MAY 2
```

Loss of AC voltage—AC spikes are often generated. Voltage drop and low AC voltage are also reported.

Restoration of AC voltage—note that minimum of 0 VAC is reported.

HIGH LINE VOLTAGE

The high line voltage measurement is made from line to neutral. The indication occurs when the peak sense equivalent rises above the high line voltage threshold continuously for longer than approximately 100 msec, or 6 cycles.



The line voltage rose above the high line threshold **and remained high** for more than 100 msec.

Causes and Solutions

Statistically, high line voltage is quite rare. Often, excessive voltage is caused by improper tap selection on a distribution transformer, which is easy to fix. If high voltages do occur for some reason, they can be eliminated by voltage regulating devices. These include:

- Ferroresonant transformers—These can provide extremely stable voltage, sometimes at the expense of start-up over-current limitations, audible noise, and harmonic distortion problems.
- Tap-switching transformers—These automatically switch taps on a transformer, often an autotransformer. There is disagreement among manufacturers as to just **when** the tap should be switched—**ASK!** Watch for **response time** (usually 1 or 2 cycles) and **power factor** limitations.
- "Line Conditioners"—A variety of devices are offered under this description, which usually offer fixes for problems other than high line voltage. These can be a good buy if the other features don't add much to the price, which is usually the case.

GS-3 PRINTOUT

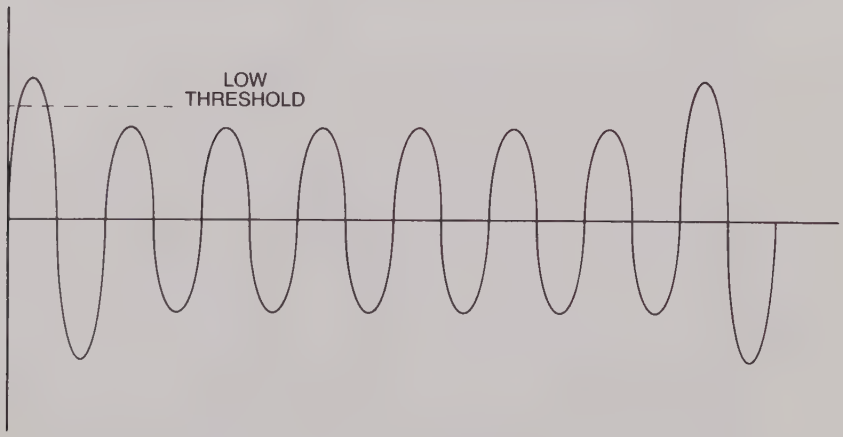
```
HIGH AC VOLT.
1:13PM MAY 2

MAX. AC VOLT.
      130 Vrms

HIGH AC
VOLTAGE ENDED.
1:13PM MAY 2
```

Indicates voltage is above the high ACV threshold.

These printouts indicate that voltage has recovered and is now below the high ACV threshold, having reached the indicated maximum.

LOW LINE VOLTAGE

The low line voltage measurement is made from line to neutral. The indication occurs when the peak sense equivalent drops below the low line voltage threshold continuously for longer than approximately 100 msec.



The line voltage fell below the low line threshold **and remained low** for more than 100 msec.

Causes and Solutions

Brief instances of low line voltage are very common occurrences. Their impact is dependent upon their magnitude and duration, and upon the type of power supply used in the equipment powered by that AC line. For this reason, the GS-3 reports only relatively long low voltage events, along with the actual voltages involved.

Low line voltage events can be caused by application of heavy loads, especially inductive loads such as electric motors (and motor-based equipment such as air conditioners). Heating elements may also be switched in and out frequently and produce low voltages. Extended low voltage occurrences may be the result of intentional electric utility "brownouts."

Solutions to low voltage are the same as for high voltage, and the same cautions apply.

GS-3 PRINTOUT

```
LOW AC VOLT.
4:39PM MAY 2

MIN. AC VOLT.
      84 Vrms

LOW AC
VOLTAGE ENDED.
4:39PM MAY 2
```

Indicates the voltage is below the low ACV threshold.

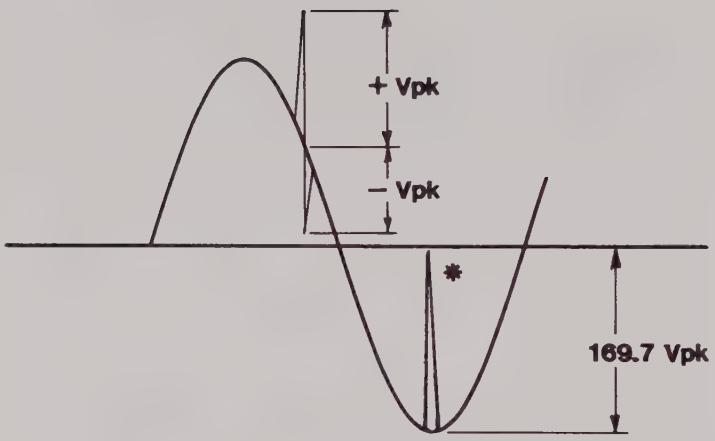
These printouts indicate that voltage has recovered and is now above the low ACV threshold, having reached the indicated minimum.

VOLTAGE SPIKE

The voltage spike measurement is made from line to ground when sensing in the PHASE-mode and from neutral to ground when sensing in the NEUTRAL-mode. The mode is switch selectable. (See the Section on OPTIONAL SWITCH SETTINGS.)

The amplitude of a voltage spike is measured as the peak voltage deviation from the normal position along the voltage sine wave. In the diagram on page 19, the positive portion of the voltage spike disturbance is + Vpk and the negative portion is − Vpk.

The monitor will evaluate both the positive and negative portions of a voltage spike disturbance and report the larger of the two values.



In this example, + Vpk is larger in magnitude than – Vpk. Thus, a spike of magnitude + Vpk would be reported, if + Vpk is greater than the voltage spike threshold.

It is extremely important to remember two things:

1) The spike amplitude is measured without regard to the amplitude of the voltage sine wave.

2) There is no information regarding position of the spike on the sine wave.

Sometimes the statement is made that a 100 volt spike on a 120 VAC line will produce a 220 volt peak. This is **FALSE.** Note the + 169.7 volt spike marked with a *. Because of its position, the voltage at the extreme point of the spike is **zero** with respect to neutral. Because the GS-3 **ignores the sine wave** when measuring spikes, the spike voltage would be correctly reported as + 170 Vpk (rounded off).

Causes and Solutions

Spikes are generated in many ways. Nature produces them via lightning and static discharge. Utilities generate them when switching feeder lines and power factor capacitors. Users generate spikes by using arc welders, copiers, fluorescent lighting, and motors with electrically noisy contacts. Speed controls using SCR's or TRIACS are among the most notorious spike generators.

Many companies offer many solutions to spikes. Many "spike suppressors" clip or limit spikes at a point approximately 200 volts above and below neutral. Others claim to track the sine wave. **ASK QUESTIONS!**

Isolation transformers eliminate "common mode" spikes, or spikes which are measured NEUTRAL-ground. They are ineffective on transverse, or normal, mode spikes.

Line conditioners and filters may be effective on spikes. On-line UPS will also eliminate spikes.

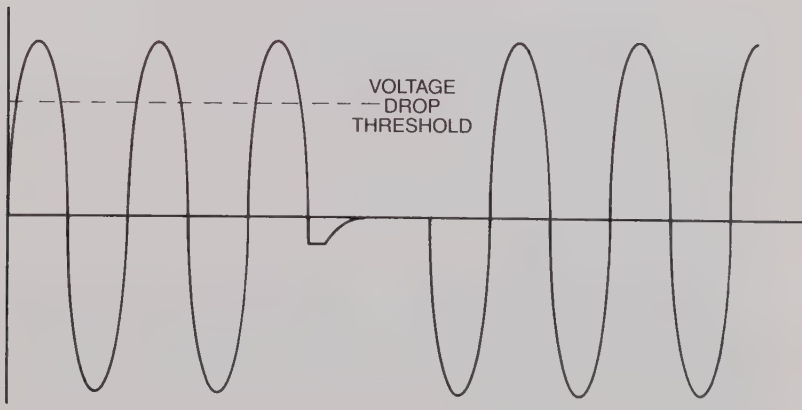
GS-3 PRINTOUT

```
AC SPIKE:
      +252 Vpk
4:36PM MAY 2
```

This is a positive spike, 252 volts from its base to its peak.

VOLTAGE DROP

The voltage drop measurement is made from line to neutral. The amplitude and timing thresholds are set by trimpots on the bottom of the monitor. The indication occurs when the peak sense equivalent drops below the voltage drop threshold continuously for longer than the voltage drop minimum duration threshold (typically 20 msec.).



Causes and Solutions

Many of the causes of low line voltage also cause voltage drops. In particular, utility switching and protective relays will cause outages on the order of 1 to 2 cycles. On-line UPS and ferroresonant transformers will eliminate these brief faults.

An off-line UPS is not designed to recognize voltage drops in time to fix them. Tap-switching transformers are also too slow to have any effect.

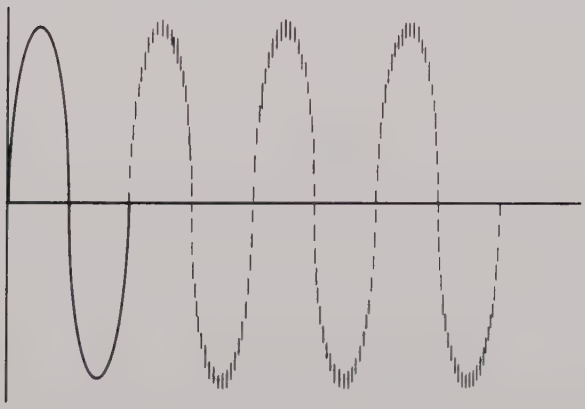
GS-3 PRINTOUT

```
VOLTAGE DROP:
5:09PM MAY 2
```

A voltage drop has occurred at the indicated time.

HIGH FREQUENCY NOISE

The high frequency noise measurement is made from line to ground when sensing in the PHASE-mode and from neutral to ground when sensing in the NEUTRAL-mode. The alarm indication occurs when the peak-to-peak noise superimposed on the power sine wave exceeds 2 volts peak-to-peak continuously for longer than 50 msec. The measurement is made at the output of a high pass filter.



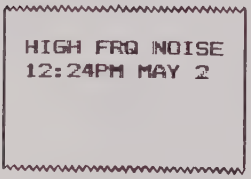
High Frequency Noise is shown superimposed on a 60 Hz sine wave.

Causes and Solutions

High frequency noise is often caused by radio transmission; e.g., radio/TV stations, walkie-talkies, and other sources such as amateur and CB radio. Ignition systems, arcing contacts, and power line communication devices are other causes.

AC line filters are often effective cures. Conducted radiation suppressors and shielding help make the equipment immune. Isolation transformers and line conditioners can also be helpful.

GS-3 PRINTOUT



Printout shows date and time of occurrence of high frequency noise.

HIGH OR LOW LINE FREQUENCY

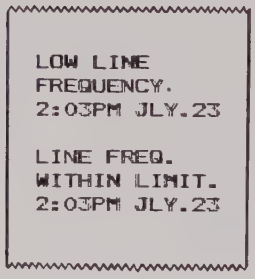
Line frequency measurements are made from line to neutral. The line frequency is determined by timing two successive zero-crossings of the sine wave. The line frequency is sampled at times determined by the processor (approximately eight times per second, except when printing). The high line frequency indication and the low line frequency indication occur when four successive samplings of the zero crossing time indicate high or low line frequency.

Causes and Solutions

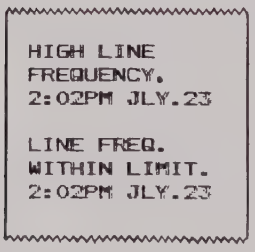
Electric utilities in North America and most of Europe and Australia control line frequency with extreme precision. Where UPS or motor generators are used, they may not be synchronized to the line frequency, or there may be misadjustment. In such case, repair or replacement may be required.

Power factor correction may cause frequency errors, which usually will happen very early in the morning (1AM - 5AM) and will not be a problem. On-line, synchronized UPS or motor generators will usually eliminate such problems while simultaneously fixing most other faults.

GS-3 PRINTOUT



Printout shows date and time of occurrence of low line frequency, as well as the date and time the frequency came back within limits.



Printout shows date and time of occurrence of high line frequency, as well as the date and time the frequency came back within limits.

SPECIFICATIONS

AC Line Voltage:

120 Vrms nominal

Switch selectable to 240 Vrms nominal

Line voltage measurement:

Range: 80 Vrms—140 Vrms (120 Vrms operation)
160 Vrms—280 Vrms (240 Vrms operation)

Accuracy: ±1.5%

Low line voltage threshold:

Standard factory setting: 105 Vrms

Front Panel adjustable, 80 Vrms—140 Vrms (120 Vrms operation)
160 Vrms—280 Vrms (240 Vrms operation)

Response time: 100 msec

High line voltage threshold:

Standard factory setting: 126 Vrms

Front panel adjustable, 80 Vrms—140 Vrms (120 Vrms operation)
160 Vrms—280 Vrms (240 Vrms operation)

Response time: 100 msec

AC Voltage Spike:

Range: −508 Vpk to +508 Vpk

Accuracy: ±10%

Response: 5 μs to stated accuracy. Useful response down to 500ns.

Threshold: Standard factory setting: 100 Vpk

Front Panel adjustable, 32 Vpk to 286 Vpk

Line Frequency:

Nominal operating frequencies: 50Hz, 60Hz (automatic internal selection)

Thresholds: ± 2Hz with respect to nominal operating frequency.

Switch selectable to ± 1Hz with respect to nominal operating frequency. (See OPTIONAL SWITCH SETTINGS, page 10.)

Accuracy: ± 0.5Hz

Response: Four consecutive samples within approximately 500 msec.

High Frequency Noise:

More than 2V pk-to-pk ± 10% for more than 50ms ± 10% at 100KHz. Usable response from 25KHz to 2MHz. Switch selectable line-to-ground sensing (PHASE-mode) or neutral-to-ground sensing (NEUTRAL-mode).

Range: 1.5V to 8V pk-to-pk (See Appendix B.)

Voltage Drop:

Threshold: 70 Vrms—140 Vrms (120 Vrms operation)
140 Vrms—280 Vrms (240 Vrms operation)

(To adjust, see Appendix B.)

Accuracy: ± 10%

Response: 10ms - 25ms (adjustable - See Appendix B.)

Standard factory settings: 80 Vrms for 20ms

Power Failure:

Range: 80 Vrms - 105 Vrms (120 Vrms operation)
160 Vrms - 210 Vrms (240 Vrms operation)

(Switch selectable—See OPTIONAL SWITCH SETTINGS, page 10.)

Accuracy: ±5%

Response: 500ms

Standard factory threshold: 90 Vrms

Power Restored:

Range: 5 Vrms above Power Failure threshold

Accuracy: ±5%

Response: 50ms

Temperature:

Range: 32° F to 127° F (0° C to 53° C). Higher temperatures are correctly reported as "OVER 127° F." Switch selectable for Celsius or Fahrenheit temperature display.

Accuracy: ±3%

Response: 5 minute settling to stated accuracy.

Thresholds: Adjustable, 60° F to 123° F (15° C to 50° C)

Standard factory thresholds: High Temp: 110° F
Low Temp: 60° F

DC SPECIFICATIONS

DC Voltage:

Range: −25 Vdc to +25 Vdc

Accuracy: ±1.5%

Standard factory thresholds: High DC: 20.0 Vdc
Low DC: 2.5 Vdc

DC Voltage Spike:

Range: −10 Vpk to −25 Vpk (negative spike)
+10 Vpk to +25 Vpk (positive spike)

Accuracy: ±5%

Response: 1 μs to stated accuracy.

Useful response down to 500ns

Standard factory threshold: 15.0 Vpk

Printing:

Black thermal printing (can be duplicated on an office copier), 14 columns, 1½" wide. Roll is 25' long.

Clock/Calendar:

Supported by internal, rechargeable Nickel-Cadmium batteries for 2 weeks minimum without line power when batteries are fully charged.

Spare battery packs available from the factory.

Operating Conditions:

32° F to 127° F (0° C to 53° C)

10 - 90% RH non-condensing.

Physical:

Monitor: 10" x 7" x 4", 7 lbs.

Temperature probe: 2" x 1" x 1", 8 ozs., 10 ft. cable

NOTE:

1. All Vrms specifications are sine peak-sense equivalent.

2. The voltage spike and high frequency noise measurements can be made from line to ground or neutral to ground (switch selectable).

3. The line frequency measurement is made by timing successive zero crossings of the power sine waves. It is sampled approximately eight times per second.

4. Monitors are calibrated at the factory for 120 Vrms unless otherwise requested.

STANDARD SET UPS

GS-3's are shipped with one of three standard threshold set ups. These set ups are for 120, 220, or 240 vac nominal. It should be noted that the frequency thresholds are actually entered into the instruments as ± 2 Hz; should the GS-3 be connected to 50 Hz, the thresholds will be printed as 52 Hz and 48 Hz.

THRESHOLD	120 NOMINAL	220 NOMINAL	240 NOMINAL
HI AC	126 Vrms	236 Vrms	268 Vrms
LO AC	105 Vrms	198 Vrms	210 Vrms
FAIL	90 Vrms	180 Vrms	180 Vrms
AC SPIKE	100 Vpk	100 Vpk	100 Vpk
HI FREQ	62 Hz	62 Hz	62 Hz
LO FREQ	58 Hz	58 Hz	58 Hz
HI TEMP	110 F	110 F	110 F
LO TEMP	60 F	60 F	60 F
HI DC	20.0 Vd	20.0 Vd	20.0 Vd
LO DC	2.5 Vd	2.5 Vd	2.5 Vd
DC SPIKE	15 Vp	15 Vp	15 Vp

APPENDIX A
SPECIAL PRINTOUTS AND EXPLANATIONS

A) THRESHOLDS

```
  --THRESHOLDS--
*HI AC:126 Vrms
*LO AC:105 Vrms
 FAIL: 90 Vrms
*AC SPK:100 Vpk
 HI FRQ: 62 Hz
 LO FRQ: 58 Hz
*HI TMP: 80°F
*LO TMP: 65°F
*HI DC: 12.2 Vd
*LO DC: 11.8 Vd
*DC SPK: 10.0 Vp
```

Push the **Print Thresholds** button to print a listing of all monitoring thresholds as shown here. See the Section on THRESHOLD ADJUSTMENTS, page 12, for a description of how to adjust thresholds marked with a "*". See the Section on OPTIONAL SWITCH SETTINGS, page 10, for a description of how to adjust the others.

B) SUMMARY

Push the **Print Summary** button twice to print a Summary of all disturbances occurring during the monitoring period. The beginning of this period is set by pushing the **Clear Summary** button. The end time is the time at which the **Summary** is requested.

```
--SUMMARY--
   FROM
1:55PM MAY 8
    TO
12:09PM JLY.3
--MIN/MAX--
MAX. AC VOLT.:
      122 Vrms
MIN. AC VOLT.:
        0 Vrms
MAX. AC SPIKE:
  OVER 508 Vpk
MAX. TEMP.:
          76°F
MIN. TEMP.:
          74°F
--HIT COUNTS--
POWER FAIL:
        9 HITS
LOW VOLTAGE:
       18 HITS
HIGH VOLTAGE:
        3 HITS
VOLTAGE SPIKE:
 OVER 254 HITS
VOLTAGE DROP:
        8 HITS
```

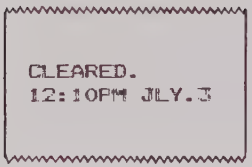
NOTE:

The "MIN/MAX" Section records variations even if thresholds are not exceeded. The "HIT COUNTS" section will count up to 254 of each type of disturbance.

Counts beyond 254 are shown as "OVER 254 HITS".

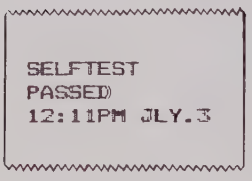
NOTE: This printout is automatically printed at midnight, unless disabled by the user. See the Section on OPTIONAL SWITCH SETTINGS, page 10.

C) CLEARED



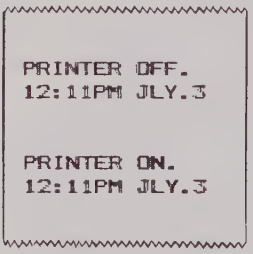
Push the **Clear** button to extinguish the LED alarms and produce this printout.

D) SELF-TEST PASSED/ SELF-TEST FAILED



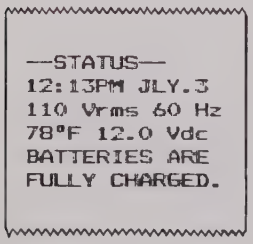
Push the **Self-test** button to check out the GS-3, as described in the Section on Self-Testing Operation, page 9. This report as shown indicates that all is well. If not, a "SELF-TEST FAILED" printout will result. In this case, consult the factory.

E) PRINTER ON/PRINTER OFF



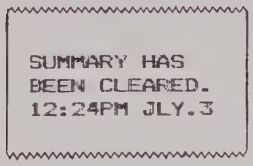
These printouts document the user's choice of printer status, to aid in the interpretation of printed Data and Summaries.

F) STATUS



This printout results from pushing the **Print Statu** button. It includes the present time and date, line voltage and frequency. Temperature and DC voltage are included if they are being monitored. The state of charge of the batteries is also shown.

G) SUMMARY HAS BEEN CLEARED



This results from pushing the **Clear Summary** button twice. All disturbance data is cleared from the Summary, and the beginning time and date for the Summary are re-initialized.

H) OVERFLOW

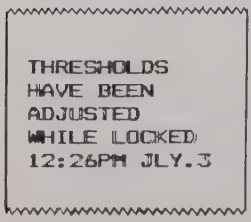
There are two types of OVERFLOW messages—"OVERFLOW: SEE SUMMARY"; and "OVERFLOW—SEE SUMMARY".

"OVERFLOW: SEE SUMMARY"—This is printed when the 6 space queue for messages **with a numerical value** is filled. This includes messages such as "AC Spike +490 Vpk" and "Min. AC Volt.85 Vrms". Note that the queue is only partly unloaded before it accepts new data, thus resulting in second and successive "OVERFLOW: SEE SUMMARY" messages separated by fewer than six disturbance messages.

"OVERFLOW—SEE SUMMARY"—This is printed when the 17 space queue **for all messages** is filled. This will rarely become filled, because of the nature of the defined disturbances and the action of the other queue.

NOTE: NO DETECTED DISTURBANCES ARE LOST. THE SUMMARY COUNTS WILL BE ACCURATE.

I. THRESHOLDS HAVE BEEN ADJUSTED WHILE LOCKED



This printout indicates that someone has tampered with the thresholds while the GS-3 was locked.

APPENDIX B
CALIBRATION ADJUSTMENT PROCEDURES

Equipment Required

Calibration of the monitor should be checked periodically. In order to check the calibration you will need the following equipment:

1. Digital true RMS voltmeter
2. Oscilloscope
3. Variable DC Voltage Supply, 0-25 Vdc
4. Power Line Spike Generator
   (EITEL Model 3020 Line Noise Generator or equivalent)
5. Line noise generator, 100KHz, 2V pk-to-pk
6. Square wave generator, 20V pk-to-pk minimum
7. Variable line voltage transformer
   (BMI Model D-2 or equivalent)
8. Standard thermometer marked in degrees Fahrenheit or degrees Celsius
9. Small slotted screwdriver

Accessing the Adjustment Trimpots

If any calibration adjustments are necessary you will need to remove the calibration seal on the bottom of the monitor to expose the trimpots. **NOTE: REMOVAL OF THIS SEAL WILL VOID ANY WARRANTY CLAIMS REGARDING MONITOR CALIBRATION.** Other warranty protection will remain. The description next to the trimpots indicates which trimpot to adjust. See Figure C-2 in Appendix C.

Getting into Calibration Mode

To perform the calibrations, the monitor must be put in the calibration mode. Press the **Print Thresholds** button three times. The monitor will respond by printing "—CALIB MODE—". The next line will read "LINE VOLTAGE". The line voltage is now ready to be calibrated.

When in the calibration mode, the **Forward** button moves the **calibration field*** to the next position. Use the **Clear** button to leave the calibration mode, and return to normal operation.

*Provides continuous display of a parameter monitored by the GS-3, such as AC voltage, temperature, etc.

Performing the Calibrations

1. **Line Voltage Calibration**

   Lift the printer door to expose the LED display. The display will be reading the present line voltage.

   Set up the meter to measure RMS voltage. Directly measure the voltage of the power line. (If your meter has a nulling feature, make sure you null the meter before taking the measurement.)

   NOTE: Verify that the AC voltage supplied to the GS-3 is an undistorted sine wave. A visual check with an oscilloscope should be adequate.

   If this measurement does not agree with the reading in the display adjust the trimpot labeled "AC voltage calibration" on the bottom of the monitor. This is done by turning the trimpot with a screwdriver until the two measurements agree. Calibration of the line voltage will then be complete.

2. **Positive AC Spike Calibration**

   This calibration procedure requires that the monitor be connected to the EITEL Model 3020 line noise generator.

   Press the **Forward** button to access the spike calibration field. The printer will print "POS. AC SPIKE".

   Using the line noise generator, generate repeated positive spikes of 200 Vpk. Measure the peak voltage of the spikes using an oscilloscope, with the oscilloscope lead connected directly to the "hot" or line conductor at the output of the line noise generator. If the display does not read "200", adjust the "AC spike calibration" trimpot.

3. **Negative AC Spike Calibration**

   Press the **Forward** button. The printer should print "NEG. AC SPIKE".

In the manner described above, generate repeated negative spikes of 200 Vpk. The display should read "200". This calibration adjustment is made inside the monitor. Adjust trimpot R103 on the lower circuit board until the display reads "200". **This adjustment should only be made after the positive AC spike measurement is calibrated.** See Figure C-6 in Appendix C.

4. Temperature Calibration

These instructions cover Model GS-3TP-B temperature probes. Temperature calibrations are made inside the temperature probe unit. Calibration requires that the temperature probe be plugged into the back of the monitor.

Press the **Forward** button to access the temperature calibration field. The printer will print "TEMPERATURE".

With the probe plugged into the monitor, measure the voltage (referenced to ground) at TP1 on the temperature probe circuit board. See Figure C-1 in Appendix C. This value should be 2.553V. If not, adjust trimpot R5.

Allow a few minutes for the ambient temperature to stabilize. Observe the temperature reading in the monitor's display. This should agree with ambient temperature near the temperature probe as measured with a standard thermometer. If it does not, adjust trimpot R9 until the two measurements agree.

The temperature probe is now fully calibrated.

5. Positive DC Spike Calibration

This calibration procedure requires a square wave generator set to provide a 20V peak-to-peak, 10Hz signal.

Press the **Forward** button to access the positive DC spike calibration field. The printer will print "POS. DC SPIKE".

Plug the DC monitoring cable into the back of the GS-3 monitor and clip the other end of this cable to the output of the square wave generator.

A NOTE OF CAUTION: the black lead on the DC monitoring cable is referenced to ground inside the monitor. If one end of the output of the wave generator is also referenced to ground, make sure the black lead on the DC cable is connected to this grounded end.

The display should read "20.0." If not, adjust the "DC spike calibration" trimpot on the bottom of the monitor.

6. **Negative DC Spike Calibration**

   Press the **Forward** button to access the negative DC spike calibration field. The printer will print "NEG. DC SPIKE".

   The negative DC spike reading should also read "20.0." If not, turn trimpot R102 on the analog board until the display reads "20.0". **This adjustment should only be made after the positive DC spike measurement is calibrated.** See Figure C-6 in Appendix C.

7. **Positive DC Voltage Calibration**

   This calibration procedure requires the use of a variable DC voltage supply.

   Press the **Forward** button to access the positive DC voltage calibration field. The printer will print "POS. DC VOLT".

   Set up the DC supply to provide exactly 12.0 volts. Connect the DC monitoring cable (positive polarity) to the voltage supply. The display should read "12.0". If not, adjust the "Positive DC voltage calibration" trimpot.

8. **Negative DC Voltage Calibration**

   Press the **Forward** button to access the negative DC voltage calibration field. The printer will print "NEG. DC VOLT".

   Make sure the negative end of the DC supply is not connected to earth ground. Reverse the polarity of the leads on the DC monitoring cable. The display should again read "12.0". If not, adjust the "Negative DC voltage calibration" trimpot.

9. **Voltage Drop Threshold Calibration**

   This calibration procedure requires the monitor to be plugged into a variable line voltage transformer.

   Press the **Forward** button. The printer will read "DROP/H.F.N.".

   Using the line voltage transformer, bring the line voltage down to the desired voltage drop threshold. (The line voltage can be measured with a digital true RMS voltmeter.)

   Carefully adjust the "Voltage drop threshold calibration" trimpot until the **Voltage Drop** alarm LED just turns on.

When adjusting this calibration trimpot, if the **Voltage Drop** alarm LED remains on all the time and will not turn off at all, turn the "Voltage drop timing calibration" trimpot fully clockwise and repeat the above procedure. If the alarm LED still will not turn off or if it will not turn on at all, the line voltage is probably out of range of the voltage drop threshold.

The voltage drop threshold is now calibrated; adjust the line voltage back to the nominal value.

10. Voltage Drop Timing Calibration

The voltage drop timing calibration procedure requires that a square wave generator be connected to the lower board inside the monitor.

The monitor should still be in the "DROP/H.F.N." calibration field.

To calibrate the timing, set up the wave generator to provide a 5V pk-to-pk, 40Hz square wave. **Greater than 5V pk-to-pk could cause permanent damage to the monitor.** Make sure the negative end of the square wave output is referenced to ground.

Open switch S7 on the analog board by lifting it up. Connect the square wave (positive) output to test point TP1. Monitor test point TP2 with an oscilloscope. See Figure C-6 in Appendix C.

Once each cycle of the square wave input, the voltage level at this test point will go low for a period of time specified as the voltage drop duration. (This is nominally set to 20ms at the factory.) Turn the "Voltage drop timing calibration" trimpot to adjust this to the desired duration (e.g. 20ms).

Remember to close switch S7 after completing this calibration procedure.

11. High Frequency Noise Calibration

The monitor should still be in the "DROP/H.F.N" calibration field.

Begin calibration by turning the "High frequency noise threshold calibration" trimpot fully clockwise. Using the line noise generator, apply 100KHz, 2V pk-to-pk noise to the power line.

Carefully turn the calibration trimpot counter-clockwise until the **High Frequency Noise** alarm LED just turns on. The high frequency noise threshold is now calibrated.

APPENDIX C
ASSEMBLY/DISSASEMBLY DIAGRAMS

	PAGE
GS-3 Temperature Probe PC Board	C-1
Calibration GS-3	C-2
Cover Removal GS-3	C-3
Opening GS-3	C-4
Analog Board GS-3	C-6
Digital Board GS-3	C-7
Analog Board Removal GS-3	C-8
Battery Pack and Printer Removal GS-3	C-9
Digital Board Removal GS-3	C-11
Assembly—Bottom GS-3	C-12
Assembly—Top GS-3	C-13

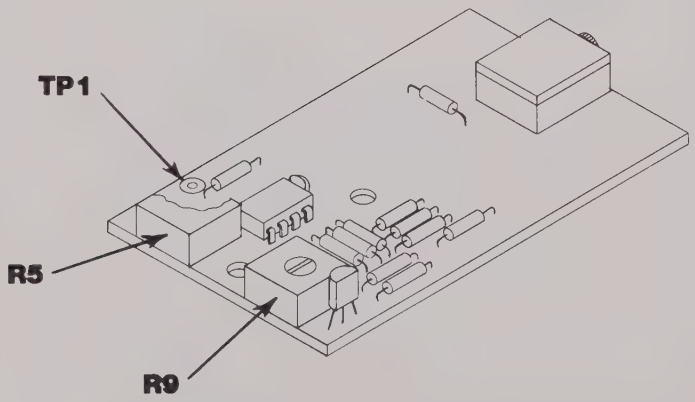


Figure C-1 : GS–3 Temperature Probe PC Board

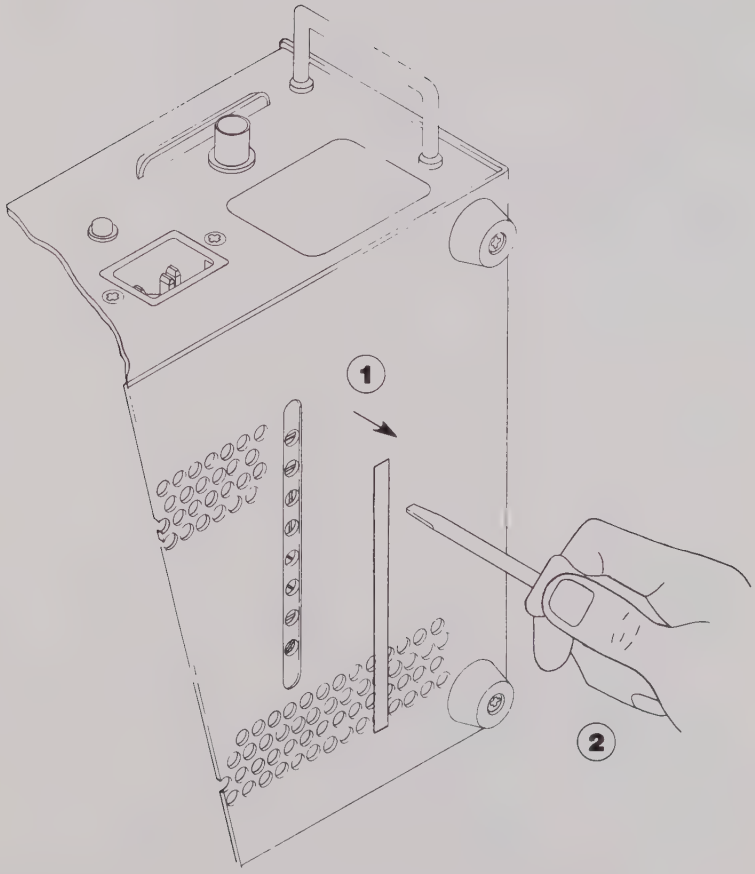


Figure C-2: Calibration GS-3

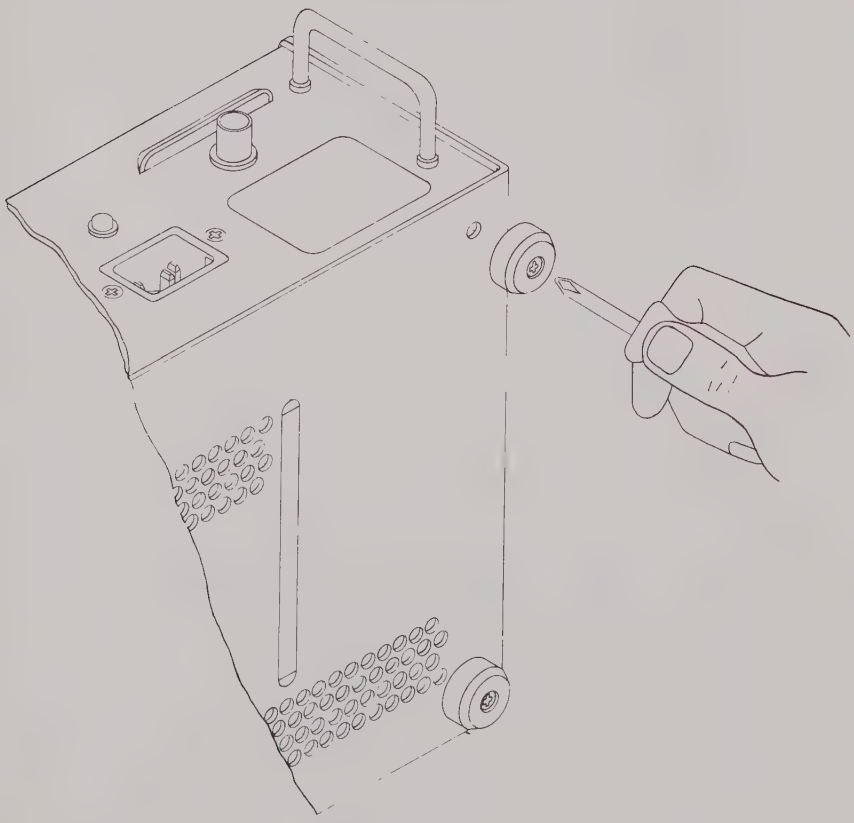


Figure C-3: Cover Removal GS-3

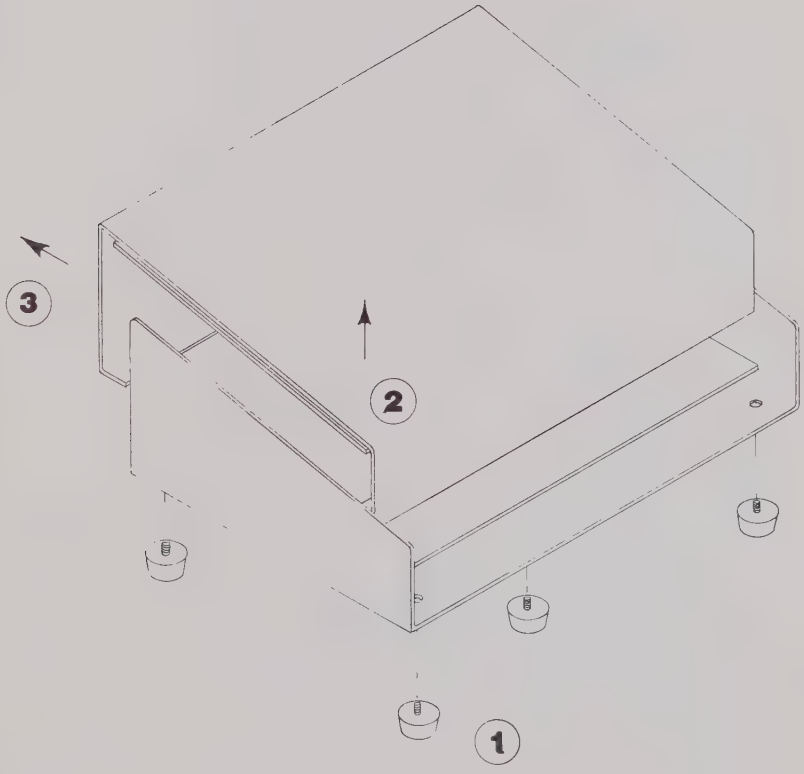


Figure C-4: Opening GS-3

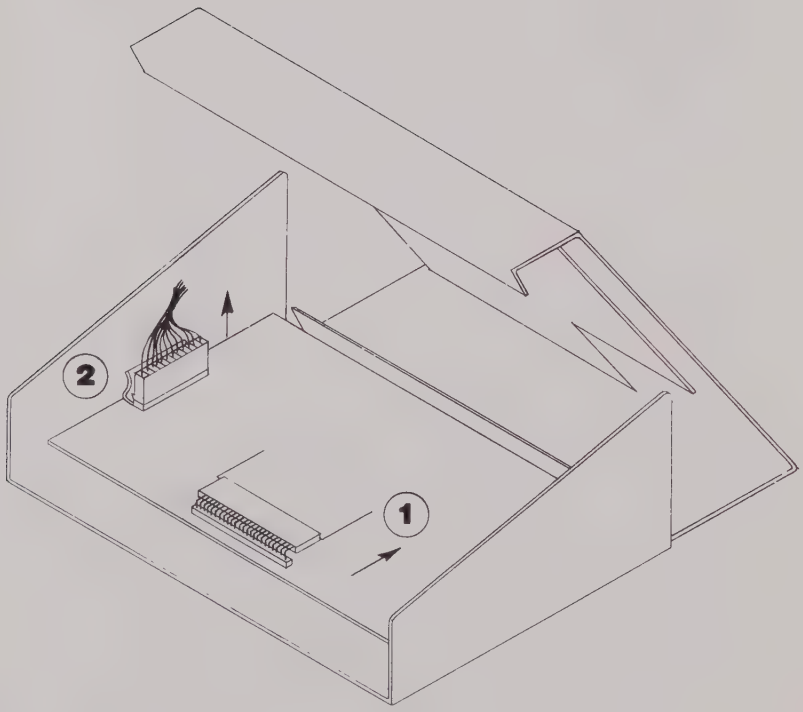


Figure C-5: Opening GS-3

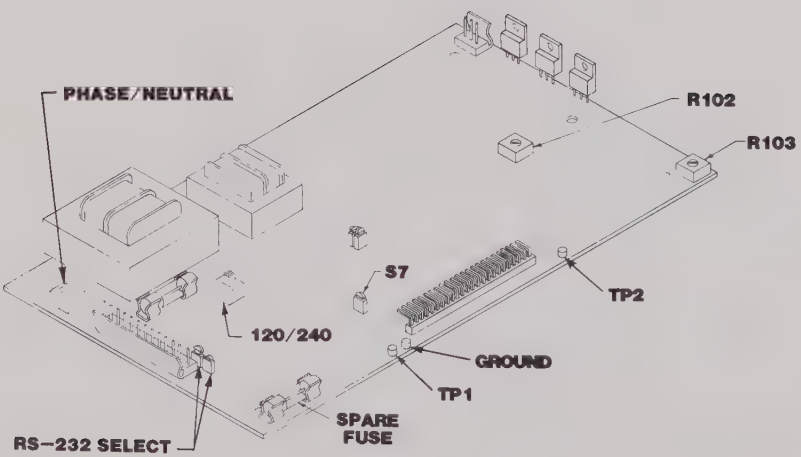


Figure C-6: Analog Board GS-3

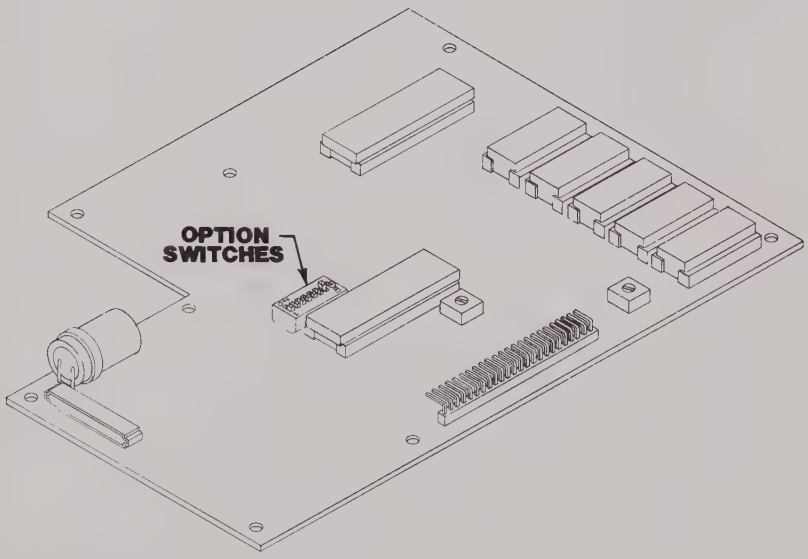


Figure C-7: Digital Board GS-3

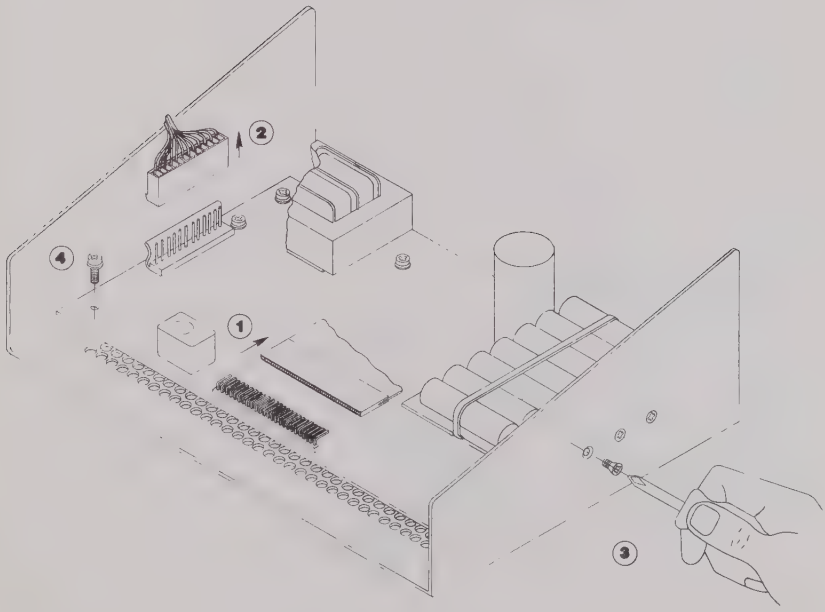


Figure C-8: Analog Board Removal GS-3

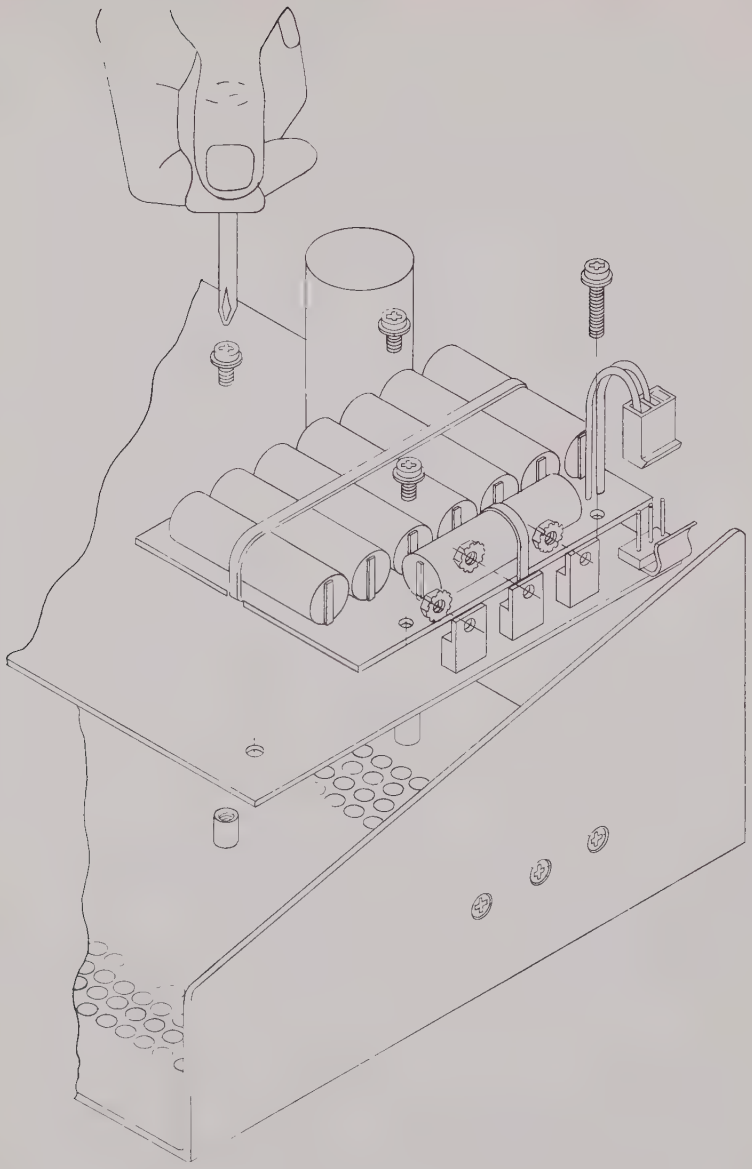


Figure C-9: Battery Pack and Printer Removal GS-3

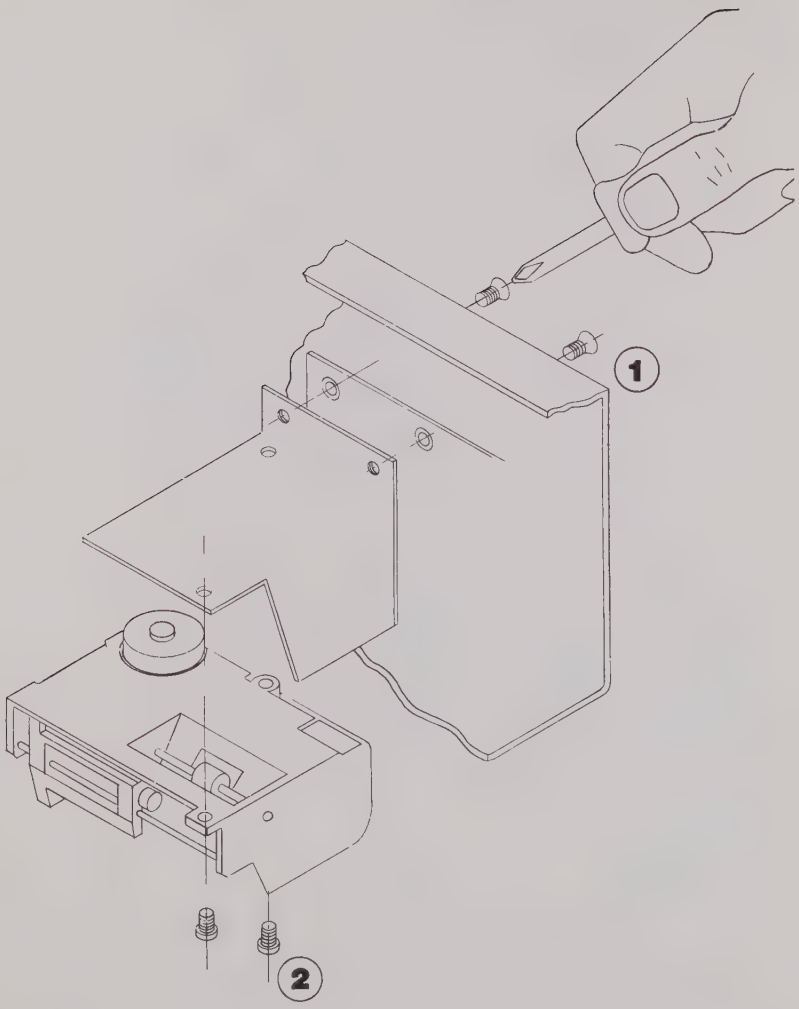


Figure C-10: Battery Pack and Printer Removal GS-3

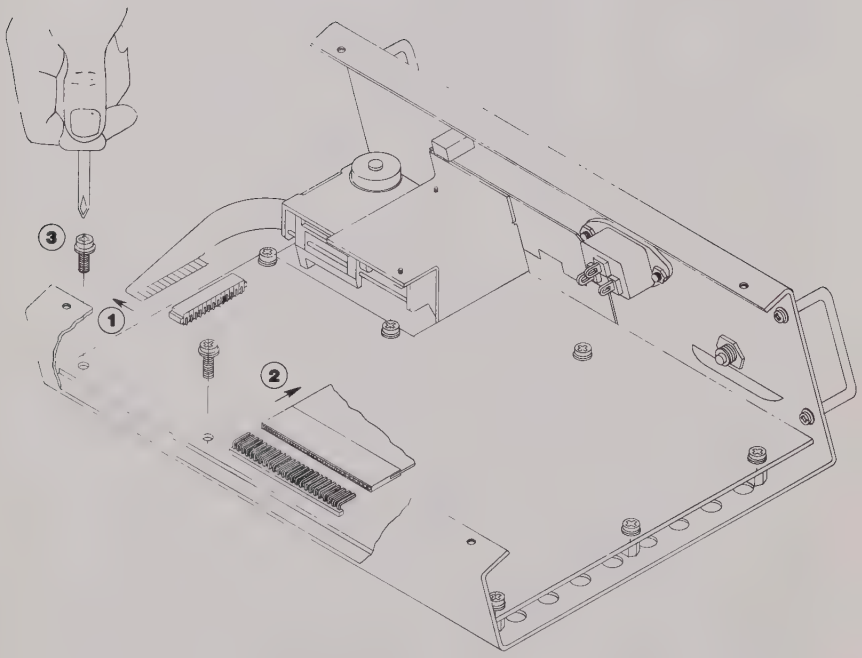


Figure C-11: Digital Board Removal

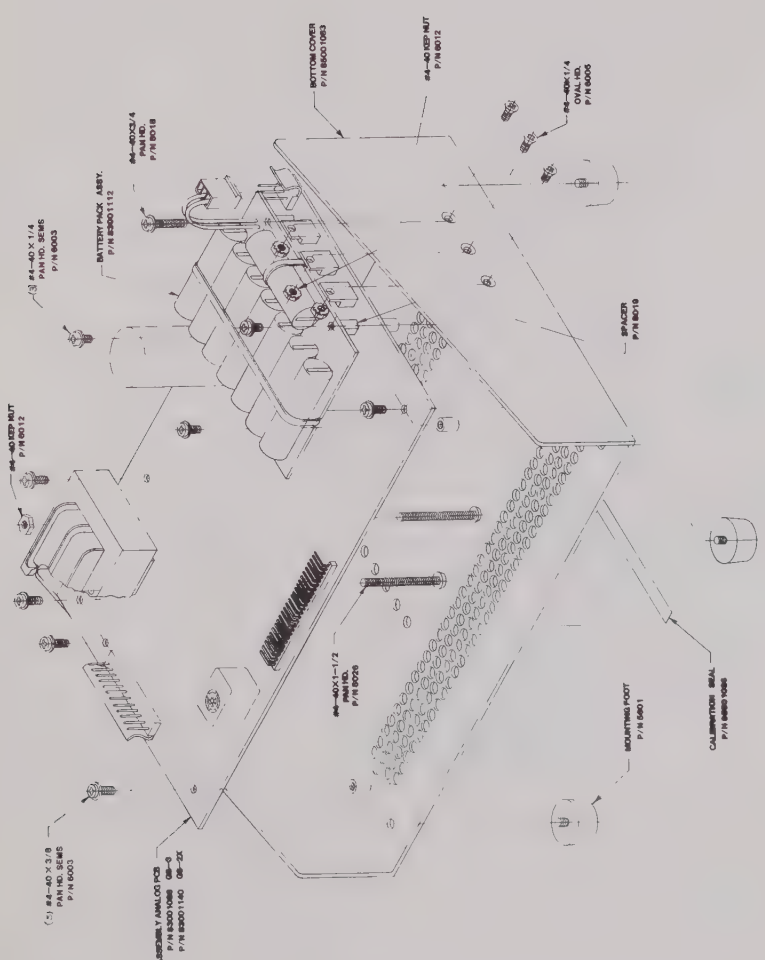


Figure C-12: Assembly-Bottom GS-3

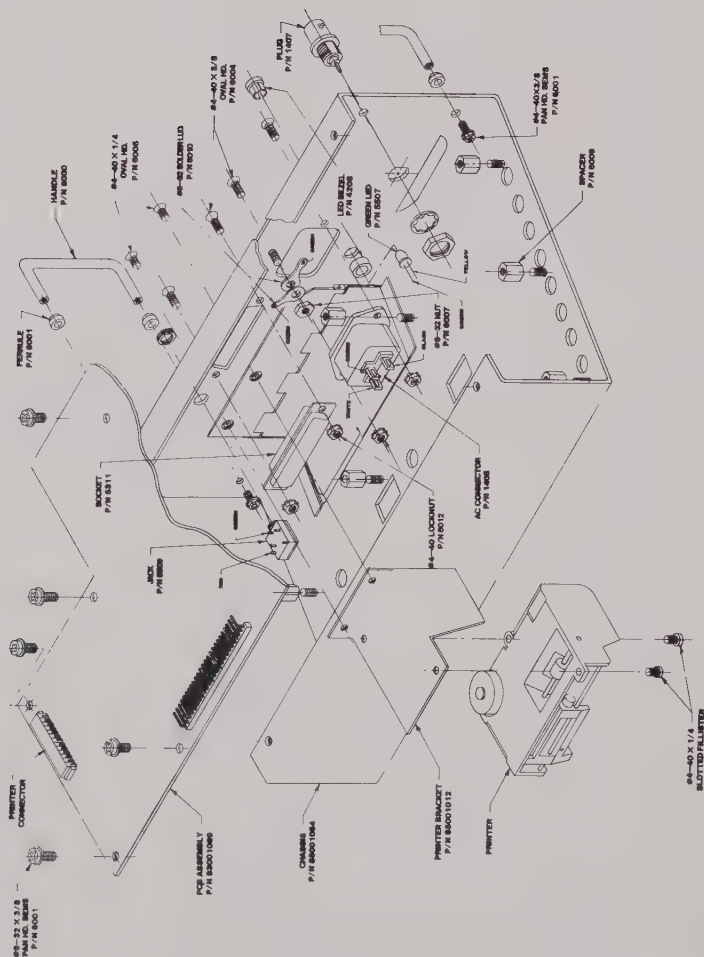
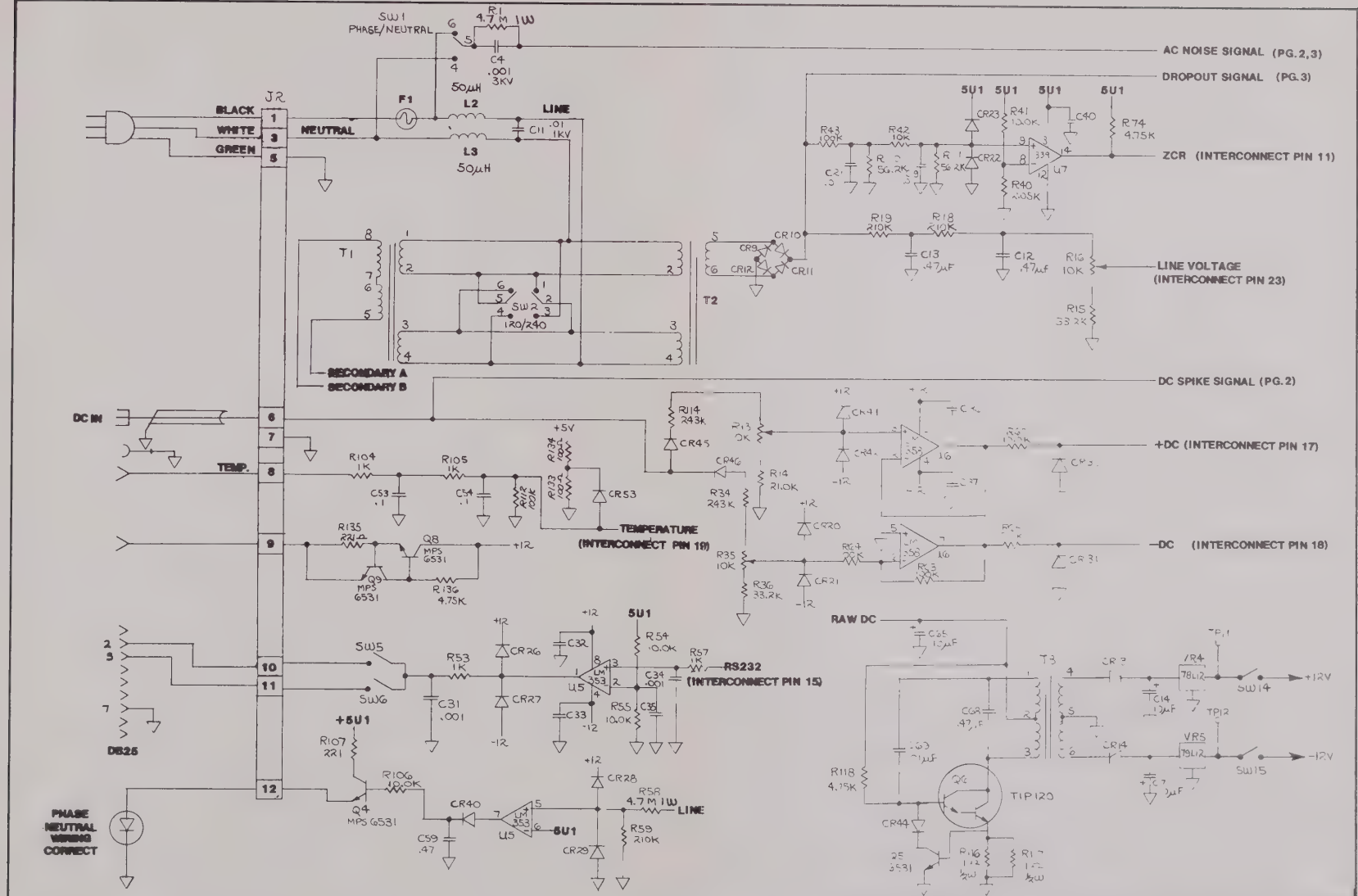

PLUG P/N 1007
#4–40 X 3/8 OVAL HD. P/N 0004
#4–40 X 1/4 OVAL HD. P/N 0005
#6–32 SOLDERLUG P/N 0010
#4–40 X 3/8 PAN HD. SEMS P/N 8001
BRACKET P/N 0008
HANDLE P/N 8000
LED BEZEL P/N 4208
GREEN LED P/N 0007
#6–32 NUT P/N 0007
FERRULE P/N 0001
BRACKET P/N 0011
AC CONNECTOR P/N 1008
#4–40 LOCKNUT P/N 0012
JACK P/N 0003
#4–40 X 1/4 SLOTTED FILLISTER P/N 0005
PRINTER CONNECTOR
#6–32 X 3/8 PAN HD. SEMS P/N 8001
PCB ASSEMBLY P/N 84001089
CHASSIS P/N 84001064
PRINTER BRACKET P/N 84001012
PRINTER

Figure C-13: Assembly–Top GS-3

APPENDIX D
SCHEMATIC DIAGRAMS

Analog PCB ..... D-2 – D-4
Digital PCB ..... D-5 – D-8
Temperature Probe D-9

NOTE: These schematic diagrams are included for illustrative purposes only and may or may not represent the exact configuration of a particular GS-3. If exact schematics are required, please contact the BMI Marketing Department at (415) 570-5355.



BMI			
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GS-3 ANALOG PCB			
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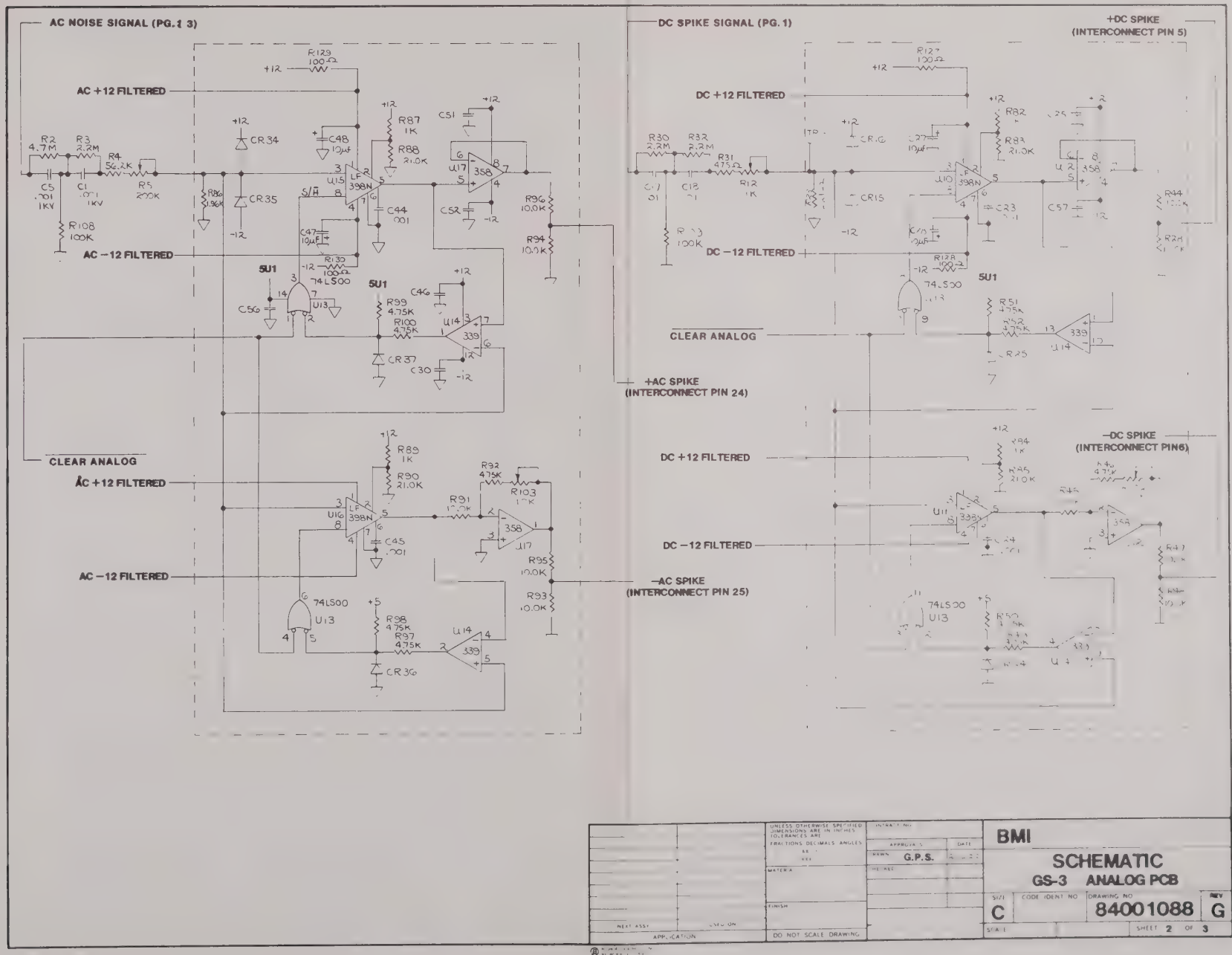
SCALE NONE		SHEET 1 OF 3	



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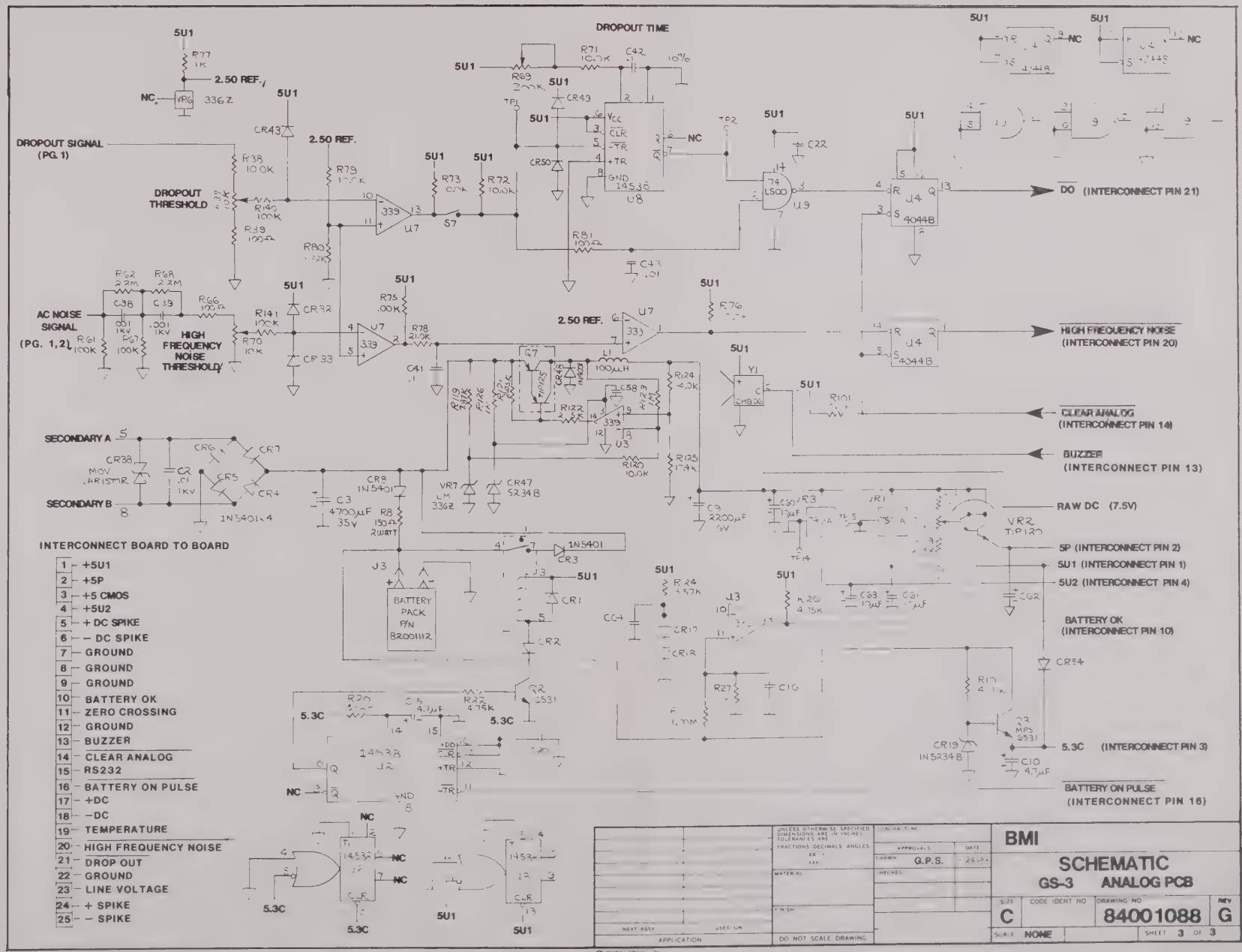
MATERIAL		SIZE C	CODE IDENT NO DRAWING NO 84001088 REV G
FINISH		SCALE	SHEET 2 OF 3
NEXT ASSY USED ON			
APPLICATION	DO NOT SCALE DRAWING		



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES .XX .XXX		APPROVALS	DATE
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NEXT ASSY	USED ON	FINISH	
APPLICATION	DO NOT SCALE DRAWING		

BMI

SCHEMATIC
GS-3 ANALOG PCB

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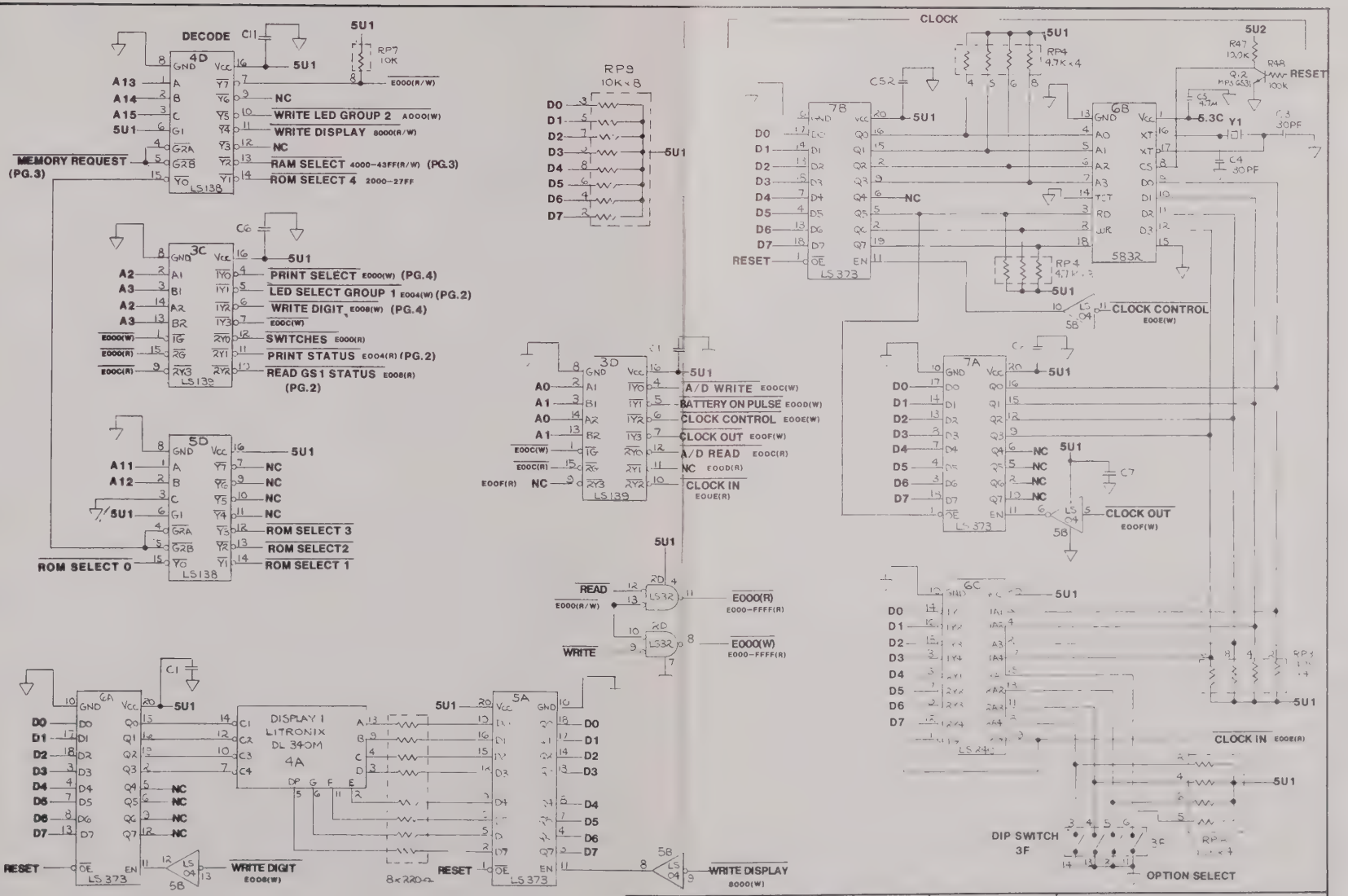
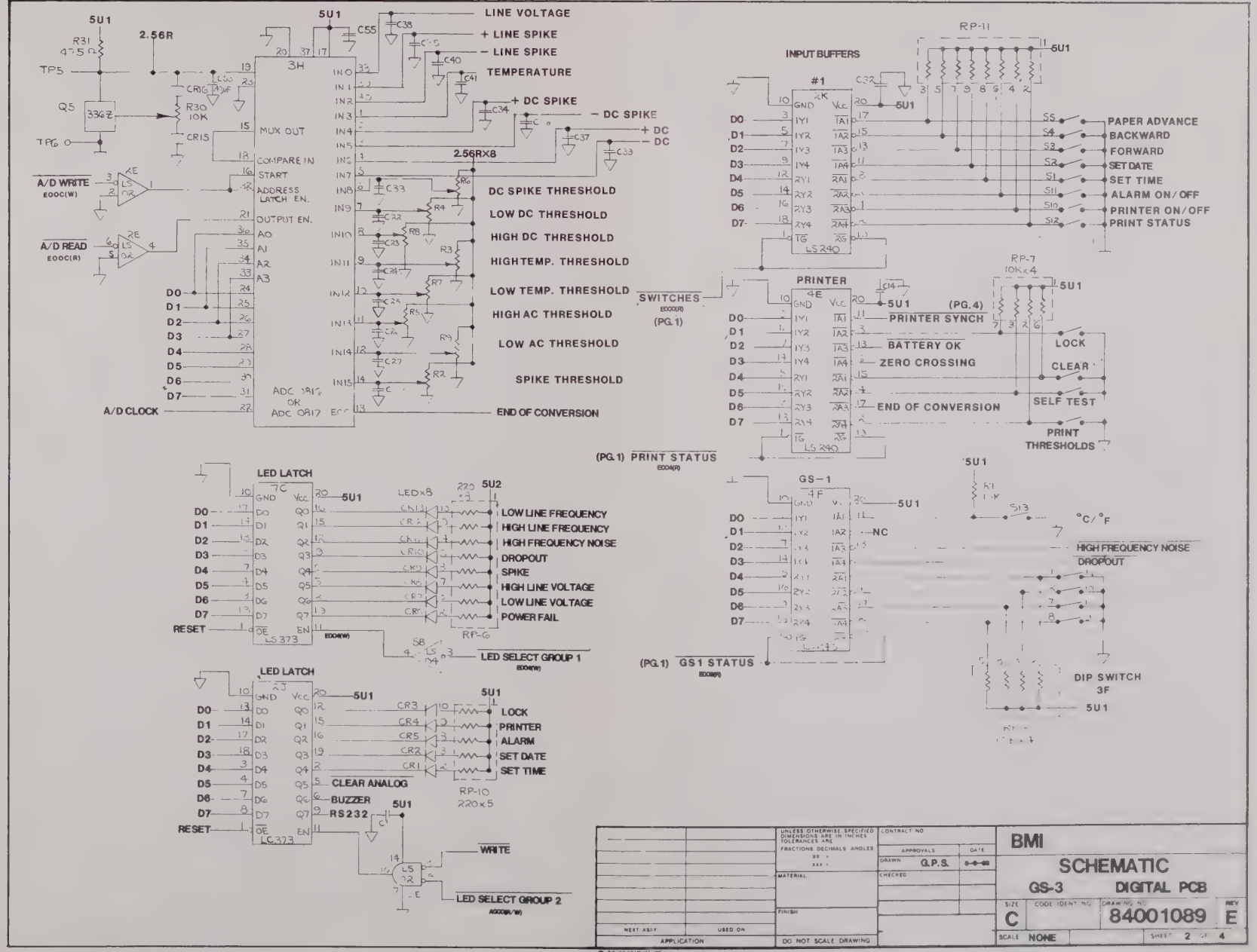
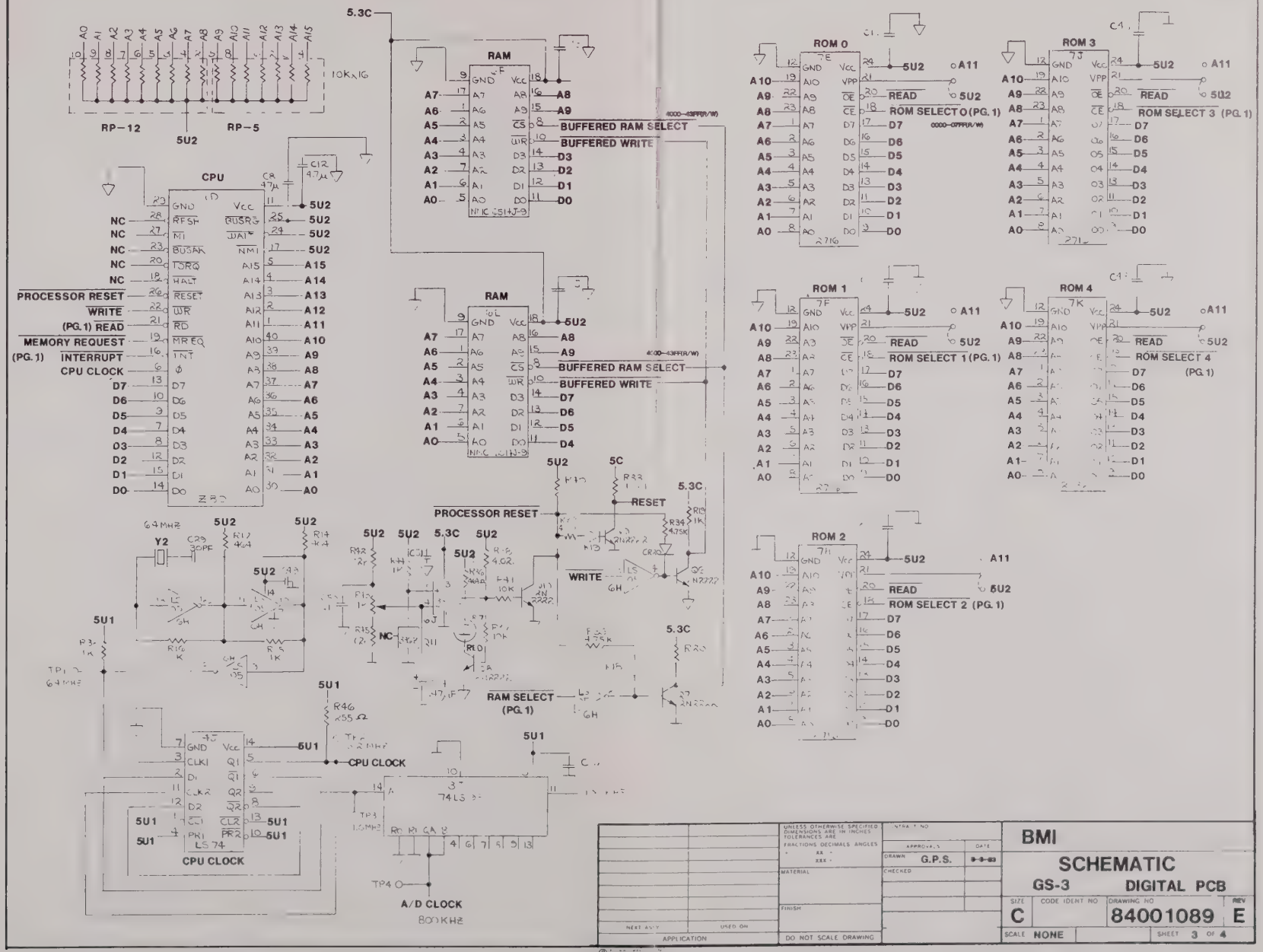
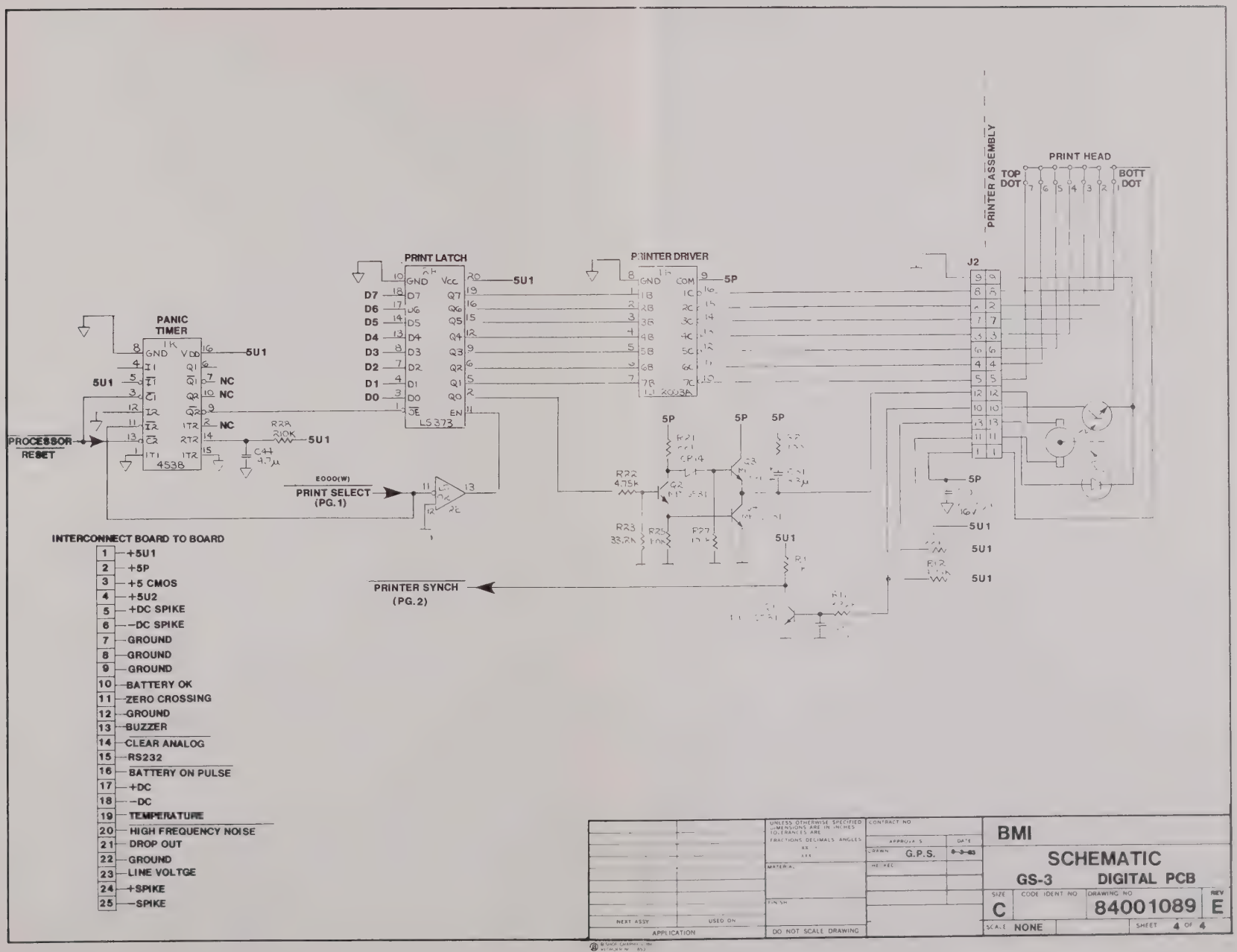
SCALE NONE SHEET 3 OF 3



NOT USED: R18, R24, R37, R38, C20, C21, C45, C46, C47	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES XX ± XXX ±	CONTRACT NO.	BMI	
LAST USED: R4, C56, Q12, Y2, TP6, CR20, S13	MATERIAL	APPR'VD'S DATE DRAWN G.P.S. CHECKED	SCHEMATIC GS-3 DIGITAL PCB	
NEXT ASSY USED ON APPLICATION	FINISH DO NOT SCALE DRAWING		SIZE C CODE IDENT NO DRAWING NO 84001089 REV E	
			SCALE NONE	SHEET 1 OF 4


5U1
R31 475Ω
2.56R
TP5
Q5
3362
TP6
R30 10K
CR15
CR16 .47μF
MUX OUT
COMPARE IN
START
ADDRESS LATCH EN.
OUTPUT EN.
A0
A1
A2
A3
A/D WRITE
EOOC(W)
A/D READ
EOOC(R)
D0
D1
D2
D3
D4
D5
D6
D7
A/D CLOCK
ADC 0816 OR ADC 0817
3H
IN0
IN1
IN2
IN3
IN4
IN5
IN6
IN7
IN8
IN9
IN10
IN11
IN12
IN13
IN14
IN15
LINE VOLTAGE
+ LINE SPIKE
- LINE SPIKE
TEMPERATURE
+ DC SPIKE
- DC SPIKE
+ DC
- DC
2.56RX8
DC SPIKE THRESHOLD
LOW DC THRESHOLD
HIGH DC THRESHOLD
HIGH TEMP. THRESHOLD
LOW TEMP. THRESHOLD
HIGH AC THRESHOLD
LOW AC THRESHOLD
SPIKE THRESHOLD
END OF CONVERSION
INPUT BUFFERS
#1
2K
LS 240
PAPER ADVANCE
BACKWARD
FORWARD
SET DATE
SET TIME
ALARM ON/OFF
PRINTER ON/OFF
PRINT STATUS
SWITCHES
EOOO(R)
(PG.1)
PRINTER
4E
(PG.4)
PRINTER SYNCH
BATTERY OK
ZERO CROSSING
END OF CONVERSION
RP-7 10Kx4
LOCK
CLEAR
SELF TEST
PRINT THRESHOLDS
LED LATCH
7C
LED x8
220
5U2
LOW LINE FREQUENCY
HIGH LINE FREQUENCY
HIGH FREQUENCY NOISE
DROPOUT
SPIKE
HIGH LINE VOLTAGE
LOW LINE VOLTAGE
POWER FAIL
RESET
OE
EN
LS 373
EOO4(W)
RP-6
LED SELECT GROUP 1
(PG.1) PRINT STATUS
EOO4(R)
GS-1
4F
NC
(PG.1) GS1 STATUS
°C/°F
HIGH FREQUENCY NOISE
DROPOUT
DIP SWITCH 3F
LED LATCH
7J
CR3
CR4
CR5
CR2
CR1
LOCK
PRINTER
ALARM
SET DATE
SET TIME
CLEAR ANALOG
BUZZER
RS232
RP-10 220x5
WRITE
LED SELECT GROUP 2
LS 32
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
MATERIAL
FINISH
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING
CONTRACT NO
APPROVALS
DATE
DRAWN G.P.S. 8-8-88
CHECKED
BMI
SCHEMATIC
GS-3 DIGITAL PCB
SIZE C
CODE IDENT NO
DRAWING NO 84001089
REV E
SCALE NONE
SHEET 2 OF 4


A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15
10K x 16
RP-12
RP-5
5U2
5.3C
RAM
BUFFERED RAM SELECT
BUFFERED WRITE
CPU
PROCESSOR RESET
WRITE
(PG.1) READ
MEMORY REQUEST
(PG.1) INTERRUPT
CPU CLOCK
ROM 0
ROM 1
ROM 2
ROM 3
ROM 4
READ
ROM SELECT 0 (PG.1)
ROM SELECT 1 (PG.1)
ROM SELECT 2 (PG.1)
ROM SELECT 3 (PG.1)
ROM SELECT 4 (PG.1)
RESET
RAM SELECT (PG.1)
64MHZ
74LS 74
A/D CLOCK
800KHZ
BMI
SCHEMATIC
GS-3 DIGITAL PCB
C
84001089
E
SCALE NONE
SHEET 3 OF 4



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MATERIAL	CHECKED	SIZE C	CODE IDENT NO
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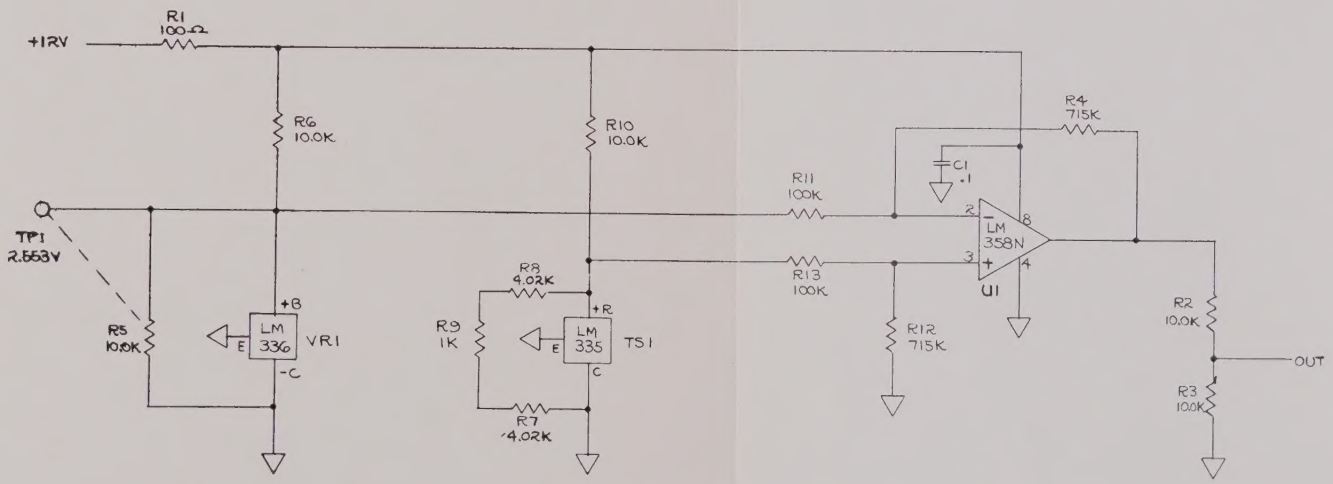
NEXT ASSY / USED ON		SCALE NONE	SHEET 4 OF 4
APPLICATION	DO NOT SCALE DRAWING		



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			DRAWN G.P.S. 9-19-83	TEMP. PROBE	GS-3
		MATERIAL	CHECKED		
		FINISH		SIZE C / CODE IDENT NO. / DRAWING NO. 84001081 / REV. C1	
NEXT ASSY	USED ON			SCALE 1 TO 1	SHEET 1 OF 1
APPLICATION		DO NOT SCALE DRAWING			

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